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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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18 Materials, Nonmetallic 1175
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Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

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28 Propulsion Systems 1203
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30 Space Sciences 1211
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31 Space Vehicles 1214
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

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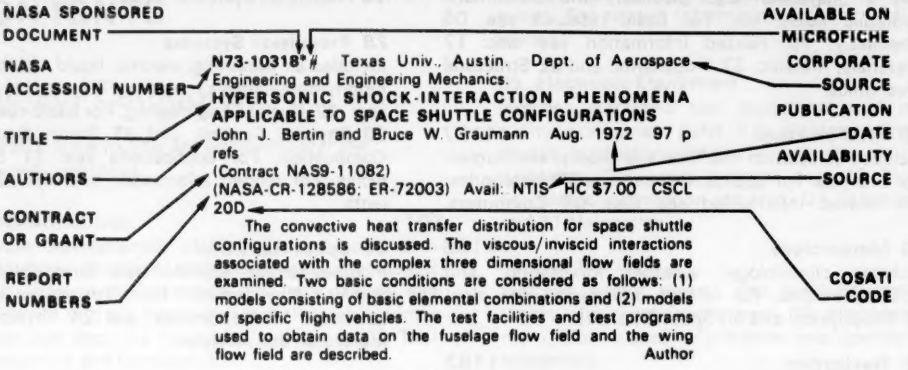
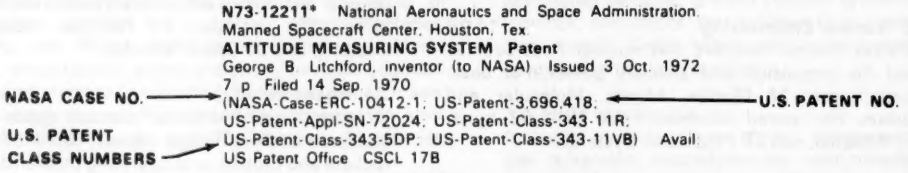


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

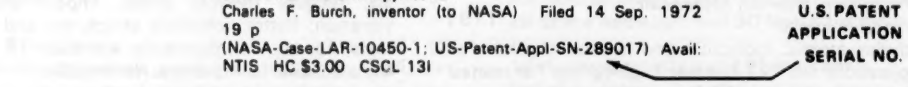
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



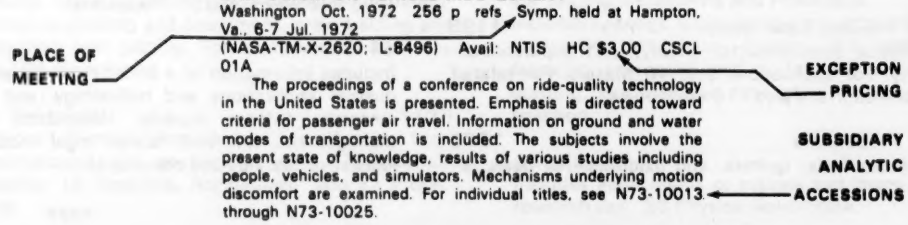
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

VOLUME 11 NUMBER 10 / MAY 23, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-18994# Aeronautical Research Labs., Melbourne (Australia).
THE AERODYNAMIC BEHAVIOUR OF A TWO-DIMENSIONAL AEROFOIL FITTED WITH SEMICIRCULAR AND SQUARE BLUNT BASES AT MACH NUMBERS UP TO 1.20
N. Pollock Jun. 1972 28 p refs Original contains color illustrations
(ARL/A-Note-336) Avail: NTIS HC $3.50

Transonic wind tunnel tests on a two-dimensional airfoil fitted with square and convex semi-circular blunt bases have been conducted over Mach number range of 0.5 to 1.2 at a base height Reynolds number of 4.2 x 1,000. A drag comparison showed that the semi-circular base had equal or greater drag than the square base in the range 0.5 to 0.96 and less drag in the range 0.96 to 1.20. At sonic speed the drag advantage of the semi-circular base reached 20 percent. Schlieren observations of the vortex shedding from the semi-circular base showed a number of acoustic resonances and some unusual photographs illustrating this phenomena are included. Author

N73-18995*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
WIND TUNNEL SIMULATION OF FULL SCALE VORTICES
James B. Rorke and Robert C. Moffitt Washington NASA Mar. 1973 115 p refs
(Contract NAS1-10446)
(NASA-CR-2180) Avail: NTIS HC $3.00 CSCL 01A

An experimental investigation has been conducted to determine the important scaling parameters for the flow in the core region of a vortex generated by a rectangular wing tip. The effect of an unconventional planform, the ogee tip, on the tip vortex is also determined. For rectangular planform wings, the measured vortex core diameter to chord ratios, peak tangential velocity ratios, and axial velocity ratios are shown to be functions only of wing lift coefficient and elapsed time from vortex formation, and appear to be independent of both Mach number and Reynolds number. The peak tangential velocities in the diffuse vortex generated by the ogee tip are only 25 percent of those in the vortex generated by the rectangular wing. Author

N73-18996*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
ANALYSIS OF HELICOPTER MANEUVER-LOADS AND ROTOR-LOADS FLIGHT TEST DATA
Edward A. Beno Washington NASA Mar. 1973 94 p refs
(Contract NAS1-11049)
(NASA-CR-2225) Avail: NTIS HC $3.00 CSCL 01C

A study was conducted in which available airload and blade response data for the NH-3A and CH-53A rotors were analyzed in an attempt to provide greater insight into the sources of rotor vibratory loads in both level and maneuvering flight. Primary emphasis in the study was placed on examining and understanding causes of high-frequency rotor control loads. Secondary objectives were: (1) to examine the effect of number of rotor blades on hub vibratory shear forces and (2) to assess which of the many terms appearing in the hub vibratory shear force expression were of most significance. Author

N73-18997# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
CALCULATION OF AERODYNAMIC DATA FOR ARTILLERY ROCKET CONFIGURATIONS BY MEANS OF A DIGITAL COMPUTER PROGRAM AND COMPARISON WITH WIND TUNNEL TEST RESULTS [DIE BERECHNUNG AERODYNAMISCHER DATEN VON ARTILLERIERAKETEN-KONFIGURATIONEN MIT HILFE EINES DIGITALPROGRAMMS UND VERGLEICH DER ERGEBNISSE MIT WINDKANALUNTERSUCHUNGEN]
H. Mathauer and S. Schultz Bonn Bundeswehramt 1972 73 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-28) Avail: NTIS HC $5.75; Bundeswehramt, Bonn: 25 DM

The calculation of the normal force coefficient, the pitching moment coefficient and the center of pressure position of wing-body combinations at zero yaw angle is described. At high angles of attack, approximate methods must be used. Because of the large amount of calculation required by these methods, the use of electronic computers is advisable. The physical assumptions are discussed on which the approximate methods used for calculating the aerodynamics of wing and body are based. The coefficients of wing-body combinations are then calculated, taking into account wing-body interference effects. The methods selected are those which make possible a relatively simple application for largely arbitrary geometries.
Author (ESRO)

N73-18998# Institut Franco-Allemand de Recherches, St. Louis (France).
CONING MOTION, AUTOROTATION, AND VORTICE SYSTEMS OF SLENDER MISSILES [KEGELPENDELUNG, AUTOROTATION UND WIRBELSYSTEME SCHLANKER FLUGKOERPER]
M. Fiechter Bonn Bundeswehramt 1972 47 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-31) Avail: NTIS HC $4.50; Bundeswehramt, Bonn: 25 DM

The coning motion of missiles with slenderness ratio between 15 and 20.5 was tested in a subsonic wind tunnel at a speed of 34.2 meters per second and a Reynolds number (with body diameter D) of 110,000. It was found that if the longitudinal axis of the model is rotated about its fixed center of gravity, the model describes a conical surface with the coning frequency constant. The coning motion begins with theta L/D between 4.7 and 5.0 and is stabilized with theta L/D between 7.1 and 7.8 with the cone half angle theta constant. The coning motion,

as well as the autorotation, which occured were found to be related to the behavior of the vortices shed by the body with the same L/D values. It was also found that the coning motion could be avoided by asymmetrically disturbing the boundary layer. Author (ESRO)

N73-18999# National Gas Turbine Establishment, Farnborough (England).
ON THE SUB-CRITICAL STABILITY OF VARIABLE RAMP INTAKES AT MACH NUMBERS AROUND 2
S. A. Fisher, M. C. Neal, and A. J. Brooks London Aeron. Res. Council 1972 38 p refs Supersedes NGTE-R311; ARC-32910
(ARC-R/M-3711; NGTE-R311; ARC-32910) Avail: NTIS HC $4.00; HMSO £1.38; PHI $5.80

The need to minimize the pre-entry drag of supersonic intakes is discussed with particular emphasis on the shock pattern in the region of the cowl lip and aerodynamic instability resulting from shear zones generated in the supersonic compression field entering the subsonic diffuser. Observations of flow instabilities made under experimental conditions are described to show instability in variable ramp intakes at Mach numbers of about 2. The two forms of instability observed in the tests are analyzed. A design technique is suggested which offers the prospect of achieving minimum pre-entry drag with freedom from instabilities induced by shear zones. Author (ESRO)

N73-19000# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A REVIEW OF WIND TUNNEL TESTS ON CIRCULATION CONTROL DEVICES FOR AIRCRAFT CONTROL
F. G. Maccabee, B. R. Hilton, and J. I. Marsh London Aeron. Res. Council 1972 87 p refs Supersedes ARC-33456; TT-71-R-04
(ARC-CP-1232; ARC-33456; TT-71-R-04) Avail: NTIS HC $6.50; HMSO £1.35; PHI $5.30

The results of wind tunnel tests made during 1968-1971 in an experimental study of blowing applied to sections of circular cylinders are reviewed. The study was aimed at exploring the possibility of producing aircraft controlling and braking forces at low speeds. Various aspect ratios and blowing arrangements were examined, including the use of two cylinders producing mutual interference effects. ESRO

N73-19001# Liege Univ. (Belgium). Lab. de Techniques Aeronautiques et Spatiales.
COMPUTATION OF THERMAL PROTECTION PANEL FLUTTER. PART 1: ASSESSMENT OF THE CALCULATION METHOD [CALCULE DE FLOTTEMENT D'UN PANNEAU DE PROTECTION THERMIQUE. PREMIERE PARTIE: MISE AU POINT DE L'OUTIL DE CALCUL]
C. Bon, M. Geradin, and G. Sander Jan. 1972 77 p refs In FRENCH
(Contract ELDO-CTR-17/2/17)
(VF-12) Avail: NTIS HC $6.00

A calculation method for the supersonic flutter of the space shuttle thermal protection panel is assessed. The method of finite elements was applied to a quadrangular plate in a supersonic flow, which represents the aerodynamic forces as functions of the generalized displacements, considered as unknown in this approach. The stiffness matrices were then derived and bi-iteration algorithms established for eigenvalue calculation. The calculation method is applied to a series of examples to verify its appropriateness. ESRO

N73-19002# Liege Univ. (Belgium). Lab. de Techniques Aeronautiques et Spatiales.
COMPUTATION OF THERMAL PROTECTION PANEL FLUTTER. PART 2: COMPUTATION OF THE AMD PANEL FLUTTER LIMITS [CALCUL DE FLOTTEMENT D'UN PANNEAU DE PROTECTION THERMIQUE. DEUXIEME PARTIE: CALCUL DES LIMITES DE FLOTTEMENT DU PANNEAU AMD]
C. Bon, M. Geradin, M. Hogge, and G. Sander Aug. 1972 49 p refs In FRENCH
(Contract ELDO-CTR-17/2/17)
(VF-16) Avail: NTIS HC $4.50

A calculation method developed for the purpose is applied to the calculation of the limits of supersonic flutter of the space shuttle thermal protection panels. The calculation is based on the study of the influence of flow obliqueness in the ascent configuration, since the ascent presents the most critical case as shown from Q/E values (Q dynamic pressure, E Young module). The reentry configuration affords a wider safety margin. The safety coefficient is calculated for several possible configurations. ESRO

N73-19003# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
EFFECT OF TWO DIMENSIONAL SUCTION FLOWS INTO DOUBLE INTAKES ON THE UPPER SURFACE OF A JOUKOWSKI AIRFOIL
K. S. Nagaraja Nov. 1972 25 p refs
(Contract AF Proj. 7064)
(AD-754208; ARL-72-0146) Avail: NTIS CSCL 20/4

Fan-in-wing type vertical take-off and landing aircraft are under investigation in the development cycle of new classes of aircraft for military and civilian missions. In view of inadequate theoretical and experimental information available, some preliminary analyses of two-dimensional problems are explored. The effect of suction flow alone on the aerodynamic characteristics of an airfoil exhibit certain novel features such as invalidation of Kutta condition for high values of intake to free stream velocity ratio. With a view to understand the flow characteristics when two intakes are located on the upper surface of a Joukowski airfoil, the two-dimensional potential flow theory is applied. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-19004* National Aeronautics and Space Administration, Washington, D.C.
AIRCRAFT CONTROL SYSTEM Patent
Paul S. Rempfer, Alan J. Robertson, Lloyd E. Stevenson, and Joseph S. Koziol, Jr., inventors (to NASA) Issued 16 Jan. 1973 8 p Filed 13 Jul. 1970 Supersedes N70-36052 (08 - 19, p 3471)
(NASA-Case-ERC-10439; US-Patent-3,711,042; US-Patent-Appl-SN-54271; US-Patent-Class-244-77D; US-Patent-Class-244-17.13; US-Patent-Class-318-489) Avail: US Patent Office CSCL 01C

An aircraft control system is described which is particularly suited to rotary wing aircraft. Longitudinal acceleration and course rate commands are derived from a manual control stick to control translational velocity of the aircraft along a flight path. In the collective channel the manual controls provide vertical velocity commands. In the yaw channel the manual controls provide sideslip or heading rate commands at high or low airspeeds, respectively. The control system permits pilots to fly along prescribed flight paths in a precise manner with relatively low work load. Official Gazette of the U.S. Patent Office

N73-19005# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
REPORT ON THE THIRD MEETING OF THE DGLR-SYMPOSIUM, FLIGHT TESTING TECHNOLOGY: RELIABILITY OF RESULTS DERIVED FROM SIMULATION IN COMPARISON WITH RESULTS OF ACTUAL FLIGHT
Oct. 1972 98 p refs Meeting held at Bremen, 28 Apr. 1972
(DLR-Mitt-72-18) Avail: NTIS HC $7.00; ZLDI Munich: 20,80 DM

The proceedings of a conference on flight testing technology are presented. The theme of the conference was the reliability of the results derived from flight simulators as compared with the results of actual flight tests. The subjects discussed

are: (1) simulation and flight test of automatic STOL landing, (2) precision of aerodynamic coefficients for flight simulation, (3) selected problems for constructing simulation models, (4) the reliability of results obtained by captive tests, and (5) the influence of the methods of flight test and simulation on the reliability of simulation results. For individual titles, see N73-19006 through N73-19011.

N73-19006 Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
COMPARISON OF SIMULATION AND FLIGHT TEST FOR AUTOMATIC STOL LANDINGS [VERGLEICH VON SIMULATION UND FLUGVERSUCH BEI AUTOMATISCHEN STOL-LANDUNGEN]
H. Boehret *In* DGLR Rept. on the 3d Meeting of the DGLR-Symp., Flight Testing Technol. Oct. 1972 p 7-28 In GERMAN (For availability see N73-19005 10-02)

The comparison of simulation and flight test results for automatic STOL landings is presented. The subjects discussed are: (1) description of flight control system, (2) control of flight path during approach, (3) control of aerodynamic flow conditions, (4) description of simulator, (5) influence of nonlinearity, and (6) application of radar for altitude measurement. Author

N73-19007 Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
OBSERVATIONS ON THE VALIDITY OF SIMULATION STUDY RESULTS IN COMPARISON WITH RESULTS FROM REAL FLIGHT TESTS [BETRACHTUNGEN ZUR GUELTIGKEIT VON ERGEBNISSEN AUS SIMULATIONSUNTERSUCHUNGEN IM VERGLEICH ZU DEN ERGEBNISSEN ECHTER FLUGVERSUCHE]
U. Schulz and H. Seelmann *In* DGLR Rept. on the 3d Meeting of the DGLR-Symp., Flight Testing Technol. Oct. 1972 p 29-52 refs In GERMAN (For availability see N73-19005 10-02)

A comparison of the validity of results obtained by flight simulation with results obtained from actual flight tests is presented. The background for the development of the simulator is discussed. The techniques for conducting the simulation are outlined. Examples of flight simulation operations are developed. Results of the comparison indicate good correlation between simulation and flight test data. Author

N73-19008 Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
ON THE ACCURACY OF AERODYNAMIC PARAMETERS FOR SIMULATION [UBER DIE GENAUIGKEIT DER AERODYNAMISCHEN BEIWERTE FUER DIE SIMULATION]
B. Haftmann *In* DGLR Rept. on the 3d Meeting of the DGLR-Symp., Flight Testing Technol. Oct. 1972 p 53-66 In GERMAN (For availability see N73-19005 10-02)

The procedure for developing the aerodynamic parameters for use in flight simulator research projects is described. Emphasis is placed on wind tunnel measurements to determine aerodynamic coefficients. Sources of error in wind tunnel measurements are analyzed. Procedures for compensating for errors arising during wind tunnel tests are explained. Results of a typical investigation are presented as graphs. Author

N73-19009 Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
SELECTED PROBLEMS OF SIMULATION MODEL FUNCTION [AUSGEWAEHLTE PROBLEME DER BILDUNG VON SIMULATIONSMODELLEN]
K. H. Unterreiner *In* DGLR Rept. on the 3d Meeting of the DGLR-Symp., Flight Testing Technol. Oct. 1972 p 67-78 In GERMAN (For availability see N73-19005 10-02)

Selected problems in the formation of simulation models are presented. The construction of a flight control system for a V/STOL aircraft simulator is used as the example. Sources of errors in the construction of the system are explained. Diagrams of typical systems are provided. Graphs of response curves and a table of performance data are included. Author

N73-19010 Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
ON THE RELIABILITY OF DORN TEST RESULTS FOR FREE FLIGHT TESTS [UEBER DIE VERLAEBLICHKEIT VON ERGEBNISSEN AUS DEM DORNVERSUCH FUER FREIFLUGVERSUCHE]
H. Goerlich *In* DGLR Rept. on the 3d Meeting of the DGLR-Symp., Flight Testing Technol. Oct. 1972 p 79-92 In GERMAN (For availability see N73-19005 10-02)

The determination of aerodynamic characteristics of aircraft while mounted on a fixed column is discussed. The construction of the test equipment to measure pitching and rolling moments is described. The advantages of using such a method as a complement to flight tests are outlined. Specific examples of tests conducted and the results obtained during captive tests are analyzed. Author

N73-19011 Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
THE EFFECT OF SIMULATION RESULT RELIABILITY ON FLIGHT TEST AND SIMULATION METHODOLOGY [ZUM EINFLUSS DE VERLAESSLICHKEIT DER SIMULATIONSRESULTATE AUF DIE METHODIK VON FLUGVERSUCH UND SIMULATION]
R. Kaestner *In* DGLR Rept. of the 3d Meeting of the DGLR-Symp., Flight Testing Technol. Oct. 1972 p 93-99 In GERMAN (For availability see N73-19005 10-02)

Various methods of flight simulation are described and a comparison of the results obtained by flight simulators with flight tests are discussed. The VAK 191B aircraft is used as an example of typical takeoff and landing performance for STOL aircraft. Diagrams of the aircraft attitude control during transition phases following takeoff and during land approach are provided. Techniques used by the test pilot in conducting the flight tests are described. Author

N73-19012*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SUMMARY OF WIND TUNNEL RESEARCH ON TILT ROTORS FROM HOVER TO CRUISE FLIGHT
Philippe Poisson-Quinton (ONERA) and Woodrow L. Cook Paris ONERA 1972 18 p refs
(NASA-TM-X-68948; ONERA-TP-1133) Avail: NTIS HC $3.00 CSCL 01C

An experimental research program has been conducted on a series of tilt rotors designed for a range of blade twist in various wind tunnel facilities. The objective was to obtain precise results on the influence of blade twist and aeroelasticity on tilt rotor performance, from hover to high speed cruise Mach number of about 0.7. global forces on the rotor, local loads and blade torsional deflection measurements were compared with theoretical predictions inside a large Reynolds-Mach-envelope. Testing techniques developed during the program are described. Author

N73-19013*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TERMINAL-AREA STOL OPERATING SYSTEMS EXPERIMENTS PROGRAM
Donald W. Smith, DeLamar Watson, and Jay V. Christensen Feb. 1973 11 p ref
(NASA-TM-X-62235) Avail: NTIS HC $3.00 CSCL 01C

Information which will aid in the choice by the U.S. Government and industry of system concepts, design criteria, operating procedures for STOL aircraft and STOL ports, STOL landing guidance systems, air traffic control systems, and airborne avionics and flight control systems. Ames has developed a terminal-area STOL operating systems experiments program which is a part of the joint DOT/NASA effort is discussed. The Ames operating systems experiments program, its objectives, the program approach, the program schedule, typical experiments, the research facilities to be used, and the program status are described. Author

N73-19014*# Linguistic Systems, Inc., Cambridge, Mass.
PREDICTION OF HELICOPTER ROTOR LOADS
J. Gallot Washington NASA Mar. 1973 18 p refs Transl. into ENGLISH of the preprint "Calcul des Charges sur Rotor d'Helicoptere" Aerospatiale, Div. Helicopters, Etablissement de Marignane, Marseille, 1972 p 3.1 - 3.8
(Contract NASw-2482)
(NASA-TT-F-14845) Avail: NTIS HC $3.00 CSCL 01C

The correct design of a rotor requires a precise knowledge

of the alternating loads to which blade and hub are submitted. The problem of the stress evaluation, from the early design stage, may lead to very sophisticated methods, because the blade is operating in a very complex environment. Nevertheless simplified methods may give sufficiently precise results to set up correctly the dimensions of the main elements of the rotor. The method described supposes simple aerodynamics, independent of blade elastic deformations. The degree of simplification achieved in this theoretical method seems to be justified by the correlation obtained with experimental airloads measured on a model rotor at the Modane Wind Tunnel, and stresses recorded on the same rotor, or a full-scale semi-articulated rotor. Author

N73-19015# National Transportation Safety Board, Washington, D.C.
SPECIAL STUDY: ACCIDENTS INVOLVING ENGINE FAILURE/MALFUNCTION US GENERAL-AVIATION 1965-1969
29 Nov. 1972 220 p
(NTSB-AAS-72-10) Avail: NTIS HC $13.00

The record of engine failure/malfunction accidents for fixed-wing aircraft which occurred in all operations of U.S. General Aviation during the period 1965-1969 is presented. It includes a comparison of the engine-failure accident rates for single-engine and multi-engine aircraft. Analyses are included concerning causes and related factors of engine-failure accidents by selected makes and models of aircraft and engines. Injury tables, analytic tables, and cause/factor tables are presented for all fixed-wing aircraft along with single-engine and multi-engine fixed-wing aircraft. Author

N73-19016*# Astro Research Corp., Santa Barbara, Calif.
GROUND AND FLIGHT TEST PROGRAM OF A STOKES-FLOW PARACHUTE: PACKAGING, DEPLOYMENT, AND SOUNDING ROCKET INTEGRATION Final Report
P. G. Niederer and D. J. Mihora 27 Sep. 1972 86 p refs
(Contract NAS1-10947)
(NASA-CR-112251) Avail: NTIS HC $6.50 CSCL 01C

The current design and hardware components of the patented 14 sqm Stokes flow parachute are described. The Stokes-flow parachute is a canopy of open mesh material, which is kept deployed by braces. Because of the light weight of its mesh material, and the high drag on its mesh elements when they operate in the Stokes-flow flight regime, this parachute has an extremely low ballistic coefficient. It provides a stable aerodynamic platform superior to conventional nonporous billowed parachutes, is exceptionally packable, and is easily contained within the canister of the Sidewinder Arcas or the RDT and E rockets. Thus, it offers the potential for gathering more meteorological data, especially at high altitudes, than conventional billowed parachutes. Methods for packaging the parachute are also recommended. These methods include schemes for folding the canopy and for automatically releasing the pressurizing fluid as the packaged parachute unfolds. Author

N73-19017*# Aerospace Corp., El Segundo, Calif.
STUDY OF V/STOL AIRCRAFT IMPLEMENTATION. VOLUME 1: SUMMARY
W. J. Portenier and H. M. Webb Washington NASA Mar. 1973 89 p refs
(Contract NAS2-6473)
(NASA-CR-2227) Avail: NTIS HC $3.00 CSCL 01C

A high density short haul air market which by 1980 is large enough to support the introduction of an independent short haul air transportation system is discussed. This system will complement the existing air transportation system and will provide relief of noise and congestion problems at conventional airports. The study has found that new aircraft, exploiting V/STOL and quiet engine technology, can be available for implementing these new services, and they can operate from existing reliever and general aviation airports. The study has also found that the major funding requirements for implementing new short haul services could be borne by private capital, and that the government funding requirement would be minimal and/or recovered through the airline ticket tax. In addition, a suitable new short haul aircraft would have a market potential for $3.5 billion in foreign sales. The long lead times needed for aircraft and engine technology development will require timely actions by federal agencies. Author

N73-19018*# General Electric Co., Cincinnati, Ohio.
REMOTE LIFT FAN STUDY PROGRAM, VOLUME 1
Aug. 1972 47 p refs
(Contract NAS3-14408)
(NASA-CR-120970-Vol-1; R72AEG242-Vol-1) Avail: NTIS HC $4.50 CSCL 01C

A summary of the concepts for achieving low noise levels for future V/STOL aircraft is presented. The combined system noise for 12 lift fan units operating at 10,000 lbs of lift (each) was not to exceed 100 PNdb at a 500 ft sideline. The candidates selected for evaluation, lift unit characteristics, weight comparison, and comparison of gas generator components are tabulated. F.O.S.

N73-19019*# General Electric Co., Cincinnati, Ohio.
REMOTE LIFT FAN STUDY PROGRAM, VOLUME 2
Aug. 1972 104 p refs
(Contract NAS3-14408)
(NASA-CR-120970-Vol-2; R72AEG242-Vol-2) Avail: NTIS HC $7.25 CSCL 01C

The engine cycle and configuration study with emphasis on the design requirements is reported. The preliminary concept survey, evaluation of selected candidates, and acoustic analysis are presented. It is concluded that single-stage tip turbines offer the best system potential with lift unit fan pressure ratios in the range 1.20 to 1.25. A compressor pressure ratio of 14/1 for the turbojet generator is recommended as the most advantageous design. F.O.S.

N73-19020*# General Electric Co., Cincinnati, Ohio.
REMOTE LIFT FAN STUDY PROGRAM, VOLUME 3
Aug. 1972 467 p refs
(Contract NAS3-14406)
(NASA-CR-120972; R72AEG242-Vol-3) Avail: NTIS HC $25.50 CSCL 01C

The preliminary aerodynamic and mechanical design of the selected gas generator and lift unit components are reported. The design features for the 1.25 and 1.2 pressure ratio lift units selected for the preliminary design are discussed along with the turbojet and turbofan gas generators. The preliminary design layout, design analysis, and gas ducting design are described. F.O.S.

N73-19021*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF CURRENT DEVELOPMENT ACTIVITY RELATED TO STOL PROPULSION NOISE REDUCTION
R. J. Rulis 1973 28 p refs Presented at Natl. Air Transportation Meeting; Miami, Fla., 24-26 Apr. 1973; sponsored by SAE
(NASA-TM-X-68195; E-7350) Avail: NTIS HC $3.50 CSCL 01C

The noise goal of 95 PNdb for STOL aircraft imposes severe technology demands on propulsion systems. Effects of this goal on the design of the propulsion system are reviewed. Results from recent development programs associated with STOL noise reduction, such as high bypass fan tests, 25 PNdb acoustic suppression tests, sonic inlets, and powered lift system noise tests, are presented. Integrated propulsion system designs for the blown flap and augmentor wing powered lift systems capable of meeting the noise goal are shown and the performance, installation, and economic penalties assessed. Author

N73-19022# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
VSTOL AIRCRAFT STABILITY AND CONTROL EXPERIENCED FROM METHODS AND RESULTS OF Do 31 FLIGHT TESTS [STABILITAET UND STEUERBARKEIT VON VSTOL-FLUGZEUGEN NACH VERFAHREN UND ERGEBNISSEN AUS DER DO 31-FLUGERPROBUNG]
Horst Wuennenberg Bonn Bundeswehramt 1972 99 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-25) Avail: NTIS HC $7.00; Bundeswehramt, Bonn: 25 DM

The problems of stability and control of V/STOL aircraft are

discussed. Though the V/STOL handling qualities criteria in AGARD-Rep. 577 and US-MIL-F-83300 correspond to a certain extent to the flight test results of the Do 31, the MIL-Spec. in particular is not applicable to jet lift V/STOL aircraft with attitude stabilization systems. As far as AGARD-Rep. 577 is concerned, additional information seems to be necessary in order to include the special problems of this category of V/STOL aircraft. The principles of control and stabilization used for the Do 31 have proved its validity and have even enabled the pilots to perform simulated IFR-transitions up to hovering flight. However, for an operational aircraft, improvements to simplify handling and further automation of the landing approach are essentially necessary for all-weather operations. Author (ESRO)

N73-19023# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

RESULTS OF VSTOL JET TRANSPORT AIRCRAFT Do 31 GROUND EROSION TESTS AND THEIR SIGNIFICANCE FOR VSTOL TECHNIQUES [ERGEBNISSE ZUR BODENEROSION BEIM VSTOL-STRAHLTRANSPORTFLUGZEUG DO 31 UND IHRE BEDEUTUNG FUER DIE VSTOL-TECHNIK]

Joerg Muench Bonn Bundeswehramt 1972 130 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-72-26) Avail: NTIS HC $8.50; Bundeswehramt, Bonn: 25 DM

The theoretical and experimental investigations on ground erosion, carried out in connection with the development of the V/STOL transport aircraft Do 31, are summarized. A mobile test rig with a one stream Orenda 14 jet engine was developed for the experiments. The resistance, which is dependent on jet intensity, was tested of wet and dry grassland at Memmingen and Oberpfaffenhofen, conventional concrete, special concrete, asphalt, synthetic coating, and ground reinforced by water-glass. The movement of particles in the wall jet was also investigated. Reduction of the lift jet intensity and special methods of STOL to avoid ground erosion are considered. Author (ESRO)

N73-19024# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

HOT GAS RECIRCULATION IN THE VSTOL JET TRANSPORT AIRCRAFT Do 31 AND ITS SIGNIFICANCE FOR FUTURE VSTOL DEVELOPMENTS [HEISSGASREZIRKULATION BEIM VSTOL-STRAHLTRANSPORTFLUGZEUG DO 31 UND IHRE BEDEUTUNG FUER ZUKUENFTIGE VSTOL-ENTWICKLUNGEN]

Peter Dick and Peter Kuehl Bonn Bundeswehramt 1972 97 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-72-29) Avail: NTIS HC $7.00; Bundeswehramt, Bonn: 25 DM

Investigations on the reingestion of hot engine exhaust gases carried out during development of the Do 31 with models and original equipment and extending over a period of five years (1964-1969) are described. The following partial objectives were met step by step: (1) determination of volume and character of the recirculation problem; (2) determination of similar characteristics in order to transfer the various model results to the full-size equipment; (3) establishment of take-off procedures; (4) optimization of safety requirements, and (5) simplification of take-off and landing procedures. With these results, the problem may be regarded as being solved for the Do 31. Further investigations to determine recirculation problems of future VSTOL jet aircraft with advanced engines revealed that certain configuration-related predictions can be made. Author (ESRO)

N73-19025# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

VSTOL TRANSITION FLIGHT TECHNIQUES AND PROBLEMS OF THE JET TRANSPORT AIRCRAFT Do 31 AND THEIR SIGNIFICANCE FOR VSTOL TECHNIQUES [TECHNIK UND PROBLEMATIK DES VSTOL-UEBERGANGSFLUGES BEIM STRAHLTRANSPORTFLUGZEUG Do 31 UND IHRE BEDEUTUNG FUER DIE VSTOL-TECHNIK]

Heribert Friedel Bonn Bundeswehramt 1972 303 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-72-30) Avail: NTIS HC $17.24; Bundeswehramt, Bonn: 25 DM

The techniques of VSTOL transition flight are explained using the Do 31 as an example. The problems presented by formulation and control of the transition flight path and their influence on transition performance are discussed in detail. The results of the Do 31 flight tests mainly concern the operation of V/STOL-aircraft. They are: take off transition is relatively easy; landing transition is very difficult and therefore uneconomic. The V/STOL operation can be improved by installation of a double control stick and an autopilot, maximum available deceleration can then be used, which is a positive safety factor in the case of an engine failure. Author (ESRO)

N73-19026# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

PRELIMINARY ECOLOGICAL EVALUATION OF THE EFFECTS OF AIR CUSHION VEHICLE TESTS ON THE ARCTIC TUNDRA OF NORTHERN ALASKA

Warren Rickard Sep. 1972 29 p refs

(ARPA Order 1615)

(AD-751741; CRREL-SR-182) Avail: NTIS CSCL 13/6

Of prime concern in the Arctic is the need for an efficient means of transportation over both frozen and unfrozen arctic terrain. As part of the effort to develop such a means, the Advanced Research Projects Agency established a program to determine the potential for using an air cushion vehicle (ACV). Studies on the effects of ACV tests were conducted in two areas at Barrow, Alaska. One area was a drained lake bottom with a fairly homogeneous vegetation cover and soil type. The second area, much drier than the first, consisted of low-centered polygons composed of a wet tundra soil and a varying vegetation complex. The initial effects of the ACV tests in both areas were quite similar. Author

N73-19027# Army Alaska, APO Seattle, Wash. 98749.

REPORT OF AN EXPERIMENT EXAMINING THE AIR CUSHION CONCEPT IN A LOGISTICAL ROLE IN THE ARCTIC Final Report

W. J. Thompson Dec. 1972 87 p

(AD-753527) Avail: NTIS CSCL 01/3

The Surface Effects Vehicle (SEV) concept experiment was conducted at Fort Greely, Alaska during the period February to September 1972. The objective of the experiment was to determine if the air cushion vehicle could be employed in a military logistical role in an Arctic environment. Air cushion vehicles have the mobility required to perform in a military logistical role in an Arctic environment in both summer and winter. The SEV can be operated and maintained in the severe Arctic environment by military personnel with aircraft maintenance skills. Author (GRA)

N73-19028# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

NOISE FROM AIRCRAFT OPERATIONS, US NAVAL AIR STATION, LEMOORE, CALIFORNIA

Aug. 1972 36 p refs

(Contract N62474-72-C-0344)

(AD-754111; BBN-2225) Avail: NTIS CSCL 20/1

The report provides descriptions of the aircraft noise environment for land areas on or in the vicinity of the Naval Air Station, Lemoore, California. The noise resulting from aircraft operations at NAS Lemoore is considered in some detail from the point of view of land use, and also with respect to potential hearing damage in maintenance areas on the station. Author (GRA)

N73-19029# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

CRITERIA FOR PREDICTING SPIN SUSCEPTIBILITY OF FIGHTER-TYPE AIRCRAFT

Robert Weissman Jun. 1972 102 p refs

(AD-753905; ASD-TR-72-48) Avail: NTIS CSCL 01C

An investigation was conducted to determine if there is a correlation between lateral-directional static stability characteristics and spin susceptibility. The effects of longitudinal static stability and adverse or proverse yaw were also considered. The motion of an airplane entering the high angle of attack, low

speed flight regime is analyzed in six degrees of freedom. The Cn beta, dynamic, and aileron-alone divergence parameters are calculated for four aerodynamic cases. Results show that these parameters have promise as criteria for predicting spin susceptibility of fighter-type aircraft in the early stages of design and development. An airplane whose Cn beta, dynamic, and aileron-alone divergence parameters are both negative at near-stall angles of attack tends to be susceptible to spinning and an airplane with positive values for these parameters tends not to be susceptible to spinning. Author (GRA)

N73-19628 Verband Deutscher Flugleiter e.V., Frankfurt am Main (West Germany).
FLIGHT SAFETY PROBLEMS FROM THE VIEWPOINT OF THE AIR TRAFFIC CONTROLLER [FLUGSICHERUNGSPROBLEME AUS DER SICHT DER FLUGLOTSEN]
Wolfgang Kassebohm *In* DGLR Report on the DGLR-Symp. on Air Traffic Operation Dec. 1972 p 49-54 In GERMAN
(For availability see N73-19623 10-21)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-19030+ Advisory Group for Aerospace Research and Development, Paris (France).
ENERGETICS FOR AIRCRAFT AUXILIARY POWER SYSTEMS
A. E. Fuhs, ed. (Naval Postgraduate School) Dec. 1972 314 p refs Mostly in ENGLISH; partly in FRENCH Proc. of 39th Meeting of the AGARD Propulsion and Energetics Panel held at Colorado Springs, 12-15 Jun. 1972
(AGARD-CP-104) Avail: NTIS HC $17.75

The proceedings of a conference on the use of superconductivity technology for electrical power generation in aircraft and missiles are presented. The advantages of superconductivity for power generation are described. The subjects discussed include: (1) behavior of composite superconducting materials, (2) superconducting generators in aircraft, (3) cryogenic and inductive energy storage, (4) advanced airborne auxiliary power systems, (5) extraction of auxiliary power from air breathing propulsion systems, (6) electrical generation and distribution systems for supersonic aircraft, and (7) non radiating superconducting coils for energy storage. Line drawings, diagrams, charts, tables, and graphs are included to clarify the theoretical aspects. For individual titles, see N73-19031 through N73-19057.

N73-19031 Supertechnology Corp., Boston, Mass.
STABILITY OF A SUPERCONDUCTOR AS INFLUENCED BY THE SUBSTRATE **c26**
Ahmed Elbindari *In* AGARD Energetics for Aircraft Auxiliary Power Systems Dec. 1972 11 p refs (For availability see N73-19030 10-03)

The effects of substrates on the stability of a superconductor are discussed. Metal cladding in superconductive technology has resulted in improved reliability in design and utilizing of critical current densities as an almost operating condition. The voltage versus current characteristics of superconductors are illustrated. A numerical analysis of the performance of multi-filament superconductors is presented. Several conclusions concerning the electrical properties of superconductors and the effects of various parameters are presented. P.N.F.

N73-19032 Warwick Univ. Coventry (England). Dept. of Engineering.
THE BEHAVIOUR OF COMPOSITE SUPERCONDUCTING MATERIALS UNDER ac CONDITIONS **c26**
A. R. Eastham and R. G. Rhodes *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 11 p refs (For availability see N73-19030 10-03)

Alternating current loss mechanisms in superconductors are described with particular emphasis on the recently developed composite materials. Alternating transport current losses of a wide range of commercially available superconductors of the bare wire and multifilament composite types are presented. The behavior in coil and cable configurations is compared, and it is shown that when self-field effects predominate, little reduction in ac loss results from using multifilament composites as opposed to bare superconducting wire. When transverse field effects predominate, a substantial decrease in loss is possible with composite materials. The effect of transposing the individual filaments within a composite has been investigated, and it is shown that the ac loss can be reduced for a limited range of conditions. Material requirements for low loss conductors are discussed. Author

N73-19033 Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
USE OF SUPERCONDUCTORS FOR PULSED EXPERIMENTS IN PLASMA PHYSICS **c26**
A. P. Martinelli *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 7 p refs (For availability see N73-19030 10-03)

Superconducting magnetics used in plasma experiments and as an essential component of possible future thermonuclear reactors are discussed. Many magnetic configurations for plasma experiments and for reactors as well consist of a stationary magnetic field produced by a superconducting magnet system on which a time dependent magnetic field is superposed. Examples are the sustained field configuration in theta pinch experiments, stellarators during switching on of the helical field, and tokamaks and stellarators during the field pulse used for ohmic heating of the plasma. The effect of pulsed magnetic fields on superconducting coils is studied in a number of non-stabilized single-core and multicore current carrying Nb-Ti superconductors in the form of short samples and small bifilar or inductive coils. Experimental results and calculation methods already reported are complemented and extended. The use and limitation of superconductors in pulsed magnetic configurations as field generating or field shielding coils are reported. Author

N73-19034 Union Carbide Corp., Tarrytown, N.Y. Linde Div.
HIGH FIELD PLASMA ARC-PLATED Nb3Sn SUPERCONDUCTING SOLENOIDS **c09**
R. Allan Reese *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 8 p refs (For availability see N73-19030 10-03)

Critical current data on plasma sprayed Nb3Sn conductor for temperatures between 4.2 and 18 K and for magnetic fields up to 92 kilo Oersteds are reported. This data and stabilization data are used to study the effect on the mass of an airborne magnet system operating at temperatures above 4.2 K, and using aluminum vs. copper stabilized conductor. The use of high conductivity aluminum is shown to substantially reduce the mass of the system. For the system considered, operation at elevated temperature is shown to result in a larger system mass since the increase in magnetic mass is much greater than the reduction in refrigerator mass. A comparison is made between refrigeration using a closed cycle refrigerator and using liquid helium carried on board. Author

N73-19035 Magnetic Corp. of America, Cambridge, Mass.
SUPERCONDUCTIVITY IN STEADY STATE AND PULSED APPLICATIONS FOR FLIGHT VEHICLES
E. J. Lucas, R. J. Thome, and Z. J. J. Stekly *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 9 p Sponsored in part by AFAPL (For availability see N73-19030 10-03)

The ability of the Type II superconductor to develop high magnetic fields while carrying high current densities naturally leads to applications that are related to power conversion and energy storage. Two major applications are presented; (1)MHD magnet systems and (2) pulsed inductive energy storage systems. The use of superconductors in winding for MHD magnets offer definite advantages in size and weight when compared with room temperature or cryogenic coils using normal conductor. This is primarily due to the higher attainable current density in the windings and is graphically illustrated in plots which indicate the relative difference in total and component weights for a given field and field volume. As specific examples, weight and volume estimates are given for the magnet systems required for

several power levels and a lightweight magnet system currently under development is described. A comparison of inductive energy storage systems making use of normally resistive cryogenically cooled and superconducting coils is presented, as well as a comparison between inductive and capacitive energy storage elements. The current state-of-the-art in pulsed superconducting energy storage is discussed together with a description of recent results using a model coil. Author

N73-19036 Cranfield Inst. of Technology (England).
PROSPECTS FOR SUPERCONDUCTING GENERATORS IN AIRCRAFT
J. T. Hayden *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 7 p refs (For availability see N73-19030 10-03)

A review is given of the characteristics of present conventional alternators and aircraft electrical power systems. Preliminary considerations in the use of superconducting windings in 400 Hz alternators indicate that it is difficult to argue a case in favour of using superconducting machines for typical systems in use at present. Futher, there is probably a minimum size of 400 Hz generator for which it is practical to introduce superconducting windings below which there is no significant reduction in weight. If systems requiring powers of a few megawatts are considered, then the case for superconducting machines is much more promising providing that some cryogen (such as liquid nitrogen or liquid hydrogen) is already in the aircraft and available for cooling intermediate heat shields. Continued development in lightweight airborne helium refrigerators is also needed. Author

N73-19037 Laboratoire Central des Industries Electriques (France).
APPLICATION OF SUPERCONDUCTIVITY TO HOMOPOLAR MACHINERY USING LIQUID METALS
J. P. Chabrerie, G. Fournet, and A. Mailffert *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 4 p refs (For availability see N73-19030 10-03)

The concept of a homopolar machine with multiple discs and superconducting field winding, using liquid metals for the armature sliding electrical contacts is described. The possibilities of these kinds of machines used as motors or power supplies are analyzed. These machines operate with a low voltage and a high armature current, and their main features are an important power-to-weight ratio and a good efficiency. The main results of several studies are presented. These studies have led to the development of a 60 kW flooded rotor homopolar motor operating at low speed (600 r/min). After a short description of the model motor and a brief account of the main test results, the paper concludes with the choice of liquid metals, their applications to more powerful machines and the influence of the use of liquid metals on the machine morphology itself. Author

N73-19038 Ferranti-Packard Electric, Ltd., Toronto (Ontario).
LIGHTWEIGHT SUPERCONDUCTION MAGNET FOR AIRBORNE MHD GENERATORS
David L. Atherton *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 9 p refs Sponsored by USAF Aeropropulsion Lab. and Canadian Defence Res. Board (For availability see N73-19030 10-03)

A large lightweight saddle-coil superconducting dipole magnet for airborne MHD generators is described. The magnet has a room temperature bore of 27.7 cm, a winding bore of 33 cm, a design field of 4.5 tesla, a magnetic length of 105 cm and a mass of 450 kilograms. The dipole field is generated by pancake winding whose cross sectional outline approximates overlapping circles. Lightweight necessitates high current density, 2,100a in a 2 mm. square conductor containing 200 twisted Nb-Ti filaments in a copper matrix. The Lorenz repulsive force between opposite sides of the magnet is 3850 kilogauss per centimeter of coil length. There are also large compressive forces on the former and repulsive forces between the ends. The mechanical structure therefore uses a highly stressed lightweight structure of filament wound epoxy glass composite. The dewar uses superinsulation and vapour cooled radiation shields. Vibration and shock analysis and pressure vessel design criteria determine the minimum mass dewar design. Author

N73-19039 Magnetic Corp. of America, Cambridge, Mass.
SUPERCONDUCTING GENERATORS
Z. J. J. Stekly (Tex. Univ. Austin) and H. H. Woodson *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 14 p refs Sponsored by United Aircraft Corp. and AFAPL (For availability see N73-19030 10-03)

The development of alternating current machines using superconducting windings is discussed. The design philosophy and details of specific experimental generators are examined. The characteristics of the field winding based on electromagnetic, electromechanical, structural, and cryogenic effects are described. The design criteria resulting from the interaction of these parameters are developed. The results of a study of size and weight as a function of power level and frequency are presented. Author

N73-19040 Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
SUPERCONDUCTING ELECTRICAL MACHINERY
C. J. Mole, J. H. Parker, Jr., and L. R. Lowry *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 15 p refs (For availability see N73-19030 10-03) (Contract F33615-71-C-1591)

The more important types of superconducting machines, the features and problems inherent in such machines, and the more promising applications are reviewed. Both ac and dc superconducting machines are discussed with particular emphasis on the application of ac machines for aircraft use. Recent and current developments in the field are reported. Author

N73-19041 Commissariat a l'Energie Atomique, Saclay (France).
ENERGY STORAGE AND DISCHARGE BY SUPERCONDUCTORS [STOCKAGE ET DECHARGE D'ENERGIE AU MOYEN DU SUPRACONDUCTEURS] c26
P. Genevey, G. Prost, J. Sole, and B. Girard *In* AGARD Energetics for Aircraft Auxiliary Power Systems Jan. 1971 8 p refs In FRENCH (For availability see N73-19030 10-03)

After an examination of the principles of electric energy storage and discharge, a detailed analysis was made of load operations, trapping, and different problems raised about storage and discharge. The effects of load operation on the utilization of high flux pumping and the discharge that is released by means of rapid transition superconductor commutators are also analyzed. Experimental results are included. Transl. by E.H.W.

N73-19042 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
RESEARCH ON CRYOGENICS AND INDUCTIVE ENERGY STORAGE AT THE DFVLR c23
C. Carpetis *In* AGARD Energetics for Aircraft Auxiliary Power systems Feb. 1972 7 p refs (For availability see N73-19030 10-03)

The use of superconducting coils for energy storage is discussed. The objective was to find the optimizing parameters and to define the problems which involve the technical use of inductive energy storage. It was determined that: (1) the geometry of the coils is essential for optimal performance, (2) high critical current density rather than high critical field is important for optimal devices, and (3) the mass of the superconductor may be small as compared with the needed structural mass. The development of cryogenically cooled devices, particularly in the presence of time varying fields, is reported. Author

N73-19043 Centre d'Etudes et Recherches de la Compagnie Electro-Mecanique, Le Bourget (France). Groupe d'Etudes Cryotechniques.
NONRADIATING SUPERCONDUCTING COILS FOR ENERGY STORAGE c23
M. Gayte, B. Girard, and A. Malandain *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 6 p refs (For availability see N73-19030 10-03)

The characteristics of superconducting coils as energy storage elements are investigated together with the main problems affecting their design: electromagnetic forces, energy radiation and discharge losses. An ellipsoid coil set into a shielding coil is then described; its outer field is zero and its shape suitable to withstand the electromagnetic forces. The relation stored

energy/superconductor volume is particularly high. An experimental coil located in a stainless steel cryostat was built allowing for the control of the calculation method and the study of the effect of the differences between the real and the theoretical shapes. Author

N73-19044 Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
ADVANCED POWER GENERATION IN MISSILES
O. Stumpf, H. Loeser, and H. Sharf *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 13 p refs (For availability see N73-19030 10-03)

Power generating systems and their application in modern missiles for the production of hydraulic and/or electric energy are discussed. A system weight analysis for 5 different systems is described which shows the application regimes in terms of output power and mission time. Details of recently developed components are given. Author

N73-19045 AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED AIRBORNE AUXILIARY POWER SYSTEM
D. F. Swenski, L. W. Norman, and A. D. Meshew *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 12 p ref (For availability see N73-19030 10-03)

An advanced auxiliary power unit (APU) was combined with an accessory drive system to form an auxiliary power system (APS). This APS was used as an exploratory development test bed for the development of advanced technology components. The APS included a 300 equivalent shaft horsepower APU configured to furnish bleed air from a split flow impeller and shaft power at 130 F, sea level ambient conditions. The APS was designed to provide standby power separate from the accessories and engine drive train, checkout, engine starting, and emergency power through a high-speed torque converter. The design of the APS was intended to form a test bed representing the optimum configuration as determined from a systems analysis, with a high degree of flexibility such that the components thus developed may be applicable to many other future APS designs. Author

N73-19046 Kloeckner-Humboldt-Deutz A.G., Oberursel (West Germany).
AUXILIARY POWER UNITS FOR SECONDARY POWER SYSTEMS
Erwin Schnell *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 9 p (For availability see N73-19030 10-03)

The design principles for the auxiliary power units of a secondary power system for use in aircraft are presented. The single shaft turbine is compared with the free power turbine for auxiliary power unit applications. The equipments operated by the auxiliary power unit is discussed and the components of the electrical system are analyzed. Author

N73-19047 Messerschmitt-Boelkow G.m.b.H., Munich (West Germany).
PULSE JET ENGINE AS A SOURCE OF ENERGY FOR AUXILIARY POWER UNITS: PULSE GAS TURBINE WITHOUT COMPRESSOR
W. K. Eick *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 12 p (For availability see N73-19030 10-03)

A short survey of the elements of an intermittent pulse jet engine, open on both sides, which has been tested up to the supersonic speed is presented. The results show that such an airbreathing unit can also be used as a gas generator acting upon a turbine rotor for taking off mechanical power. The basic design of the engine consists of a thin-walled welded steel construction of conical and cylindrical shape, without any mechanically moved, rotating or oscillating parts. A spark plug for intermittent external ignition for starting and a fuel control device belong to the basic version of the engine. The turbine is driven by the hot gases which are intermittently expelled from the combustion chamber. The power unit can also be selectively used after diversion as a propulsion engine. The low costs of manufacturing and maintenance for such engines are pointed out. The influence of the most important parameters is explained. The auto-ignition, based on the principle of residual gas including shock wave rate, is an important functional feature of the pulse jet engine. Author

N73-19048 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Auxiliary Power Units.
DUAL MODE AUXILIARY POWER UNIT FOR HIGH MACH AIRCRAFT
Buryl L. McFadden, Jr. and Richard E. Quigley, Jr. *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1973 9 p refs (For availability see N73-19030 10-03)

Advanced high performance aircraft are projected to employ ramjet, turboramjet, and rocketramjet engines. Since ramjet engines do not incorporate rotating members, they cannot provide shaft horsepower for aircraft accessories and flight control systems. Therefore, some form of auxiliary power source will be required to furnish the hydraulic, electric, pneumatic, and shaft power for the various aircraft systems during flight, thus the auxiliary power source must become the prime and only source of shaft power during high speed flight. Various power source configurations to accomplish this are reviewed with emphasis on the potential of a single dual mode power source sized to provide all flight vehicle power throughout the entire operating regime of the aircraft including ground standby. Since they are totally independent, such a configuration will permit design optimization of both the main propulsion engines and the power system. Author

N73-19049 British Aircraft Corp., Preston (England). Military Aircraft Div.
INTEGRATION OF AUXILIARY POWER SYSTEMS WITH THE MULTI-SPOOL ENGINE
Len. W. Milsom *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1973 8 p (For availability see N73-19030 10-03)

As engine technology advances certain engine/airframe interface problems arise with aircraft auxiliary power systems. Using a modern strike aircraft as the principal example, this paper examines the difficulties in meeting the airframe mechanical power requirements of generating excessive wasted energy in air bleed systems and of dissipating the waste heat from engine and airframe accessories. Much closer collaboration between airframe and engine contractors at the early stage of an aircraft project, in order to develop a combined approach to the solution of these problems, is recommended. Author

N73-19050 Motoren-Und Turbinen-Union Muenchen G.m.b.H. (West Germany).
EXTRACTION OF AUXILIARY POWER FROM AIRBREATHING PROPULSION SYSTEMS
Klaus Bauerfeind *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1973 13 p (For availability see N73-19030 10-03)

The characteristics of gas turbine engines for use as auxiliary power sources are discussed. The direct supply of mechanical power and pressurized air from turbines is examined. The most important criteria for the auxiliary power sources are identified as: (1) maximum possible power delivery points, (2) compressor surge margins, (3) effect on handling characteristics of aircraft, and (4) effect on windmilling characteristics of turbine engine. Data are presented in the form of graphs to show interrelationships of turbine engine parameters. Author

N73-19051 Politecnico di Milano (Italy). Ist. di Macchine.
A METHOD FOR PRELIMINARY ANALYSIS OF MHD GENERATOR PERFORMANCE
C. Casci, A. Coghe, and U. Ghezzi *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 12 p refs (For availability see N73-19030 10-03)

The characteristics of magnetohydrodynamic generators for aircraft and spacecraft applications are discussed. A method for analyzing the parameters of a magnetohydrodynamic generator is developed. The analysis is obtained by fixing the total enthalpic difference between the inlet and outlet sections of the duct and by examining the various possibilities through which such a condition may be achieved. Thermodynamic and electromagnetic quantities are studied in relation to the velocity difference between the inlet and outlet sections of the duct and by some other

parameters, such as expansion ratio and form factor of the duct. Author

N73-19052 Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
DEVELOPMENTS IN AIRCRAFT ELECTRICAL POWER SYSTEMS
Robert H. Johnson *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 7 p refs (For availability see N73-19030 10-03)

A summary of Air Force research and development programs in aircraft electrical power systems and components is presented. The planning process used to validate research programs is discussed with emphasis on the resultant motivation to develop specific classes of technology. Specific programs discussed are: (1) solid state power controllers, (2) gate controlled switch technology, (3) solid state electric power simulator tests, and (4) high temperature electrical generators, wire, and connectors. Author

N73-19053 Vought Aeronautics, Dallas, Tex.
APPLICATION OF SOLID STATE SWITCHING AND MULTIPLEXING TO AIRCRAFT ELECTRICAL SYSTEMS
Clyde W. Jones (AFAPL) and Jim Courter *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1973 9 p (For availability see N73-19030 10-03)

The application of solid state switching, multiplexing, and electrically programmable logic to aircraft electrical systems is discussed. The effects of the use of solid state switching technology on electrical system weight, reliability, electromagnetic interference, and quality of power delivered to loads are analyzed. A summary of problems encountered with proposed solutions, during a program in which a completely solid state electrical system for an A-7 aircraft was evaluated, is included. Areas of improvement and expanded capability are also enumerated. Author

N73-19054 Royal Aircraft Establishment, Farnborough (England). Engineering Physics Dept.
ELECTRICAL GENERATION AND DISTRIBUTION SYSTEMS FOR FUTURE SUPERSONIC AIRCRAFT
A. Bainbridge *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 7 p refs (For availability see N73-19030 10-03)

The size of the total electrical load and the temperature range over which some components will have to operate make it necessary to study new generation and distribution techniques to satisfy the demands of future aircraft flying in the supersonic or hypersonic range. This paper is restricted to supersonic aircraft and discusses recent proposals for improved distribution systems incorporating solid state switching and using remote control of protective devices through a multiplexed system. The scope for high temperature wiring is briefly discussed and a few recent developments in generators and power cables are described, since the generating system is particularly vulnerable to extreme environmental conditions. Author

N73-19055 Societe d'Applications des Machines Motrices S.A., Issy-les-Moulineaux (France).
ADIABATIC COMPRESSION OF OILS EASILY MEASURED FROM PUMP AND MOTOR YIELD [COMPRESSION ADIABATIQUE DES HUILES MESURES AISEES DES RENDEMENTS DES POMPES ET MOTEURS]
Jacques Faisandler *In* AGARD Energetics for Aircraft Auxiliary Power Systems Dec. 1972 8 p In FRENCH (For availability see N73-19030 10-03)

Formulas are reported for calculating the influence of adiabatic oil compression on transmission power of hydraulic systems. Calculations were also made of pump and motor destruction, and the valve of thermal destruction due to oil overheating in the pumps. Transl. by E.H.W.

N73-19056 British Aircraft Corp., Weybridge (England).
PNEUMATICS IN SUPERSONIC ENERGETICS
John Wotton *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1973 15 p (For availability see N73-19030 10-03)

A pneumatics orientated integrated system concept developed for subsonic civil aircraft is examined in its relation to supersonic operation. The principle of waste heat extraction for the generation of auxiliary power supplies is found to be even more viable due to greater cabin pressure differential during cruise, and the level of engine compressor tapping required in consequence. The economics of engine bleed are examined in the light of virtually free electrical generation in the method employed. Pneumatic power conversion is shown to be at least competitive with hydraulic and other equivalents, and the requirements of power flying controls to be satisfactorily met. Author

N73-19057 Pisa Univ. (Italy). Facolta di Ingegneria.
THEORETICAL MODELS FOR PLASMA MOTION IN PULSED COAXIAL HYDROMAGNETIC GUNS c11
M. Andrenucci, M. Caprili, and R. Lazzeretti *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 17 p refs (For availability see N73-19030 10-03)

A theoretical study of the performance of pulsed coaxial plasma guns is described. The electromechanical equations are derived for a snowplow model allowing for a variable initial mass-loading distribution. Computer results for two families of distributions are presented and analyzed. The values of the system parameters that yield highest value of kinetic efficiency are determined for widely varied conditions. A modified model allowing for the actual variation of the magnetic pressure with the radius is formulated and preliminary results for this model are discussed. Finally an account is given of the numerical methods employed in solving the sets of coupled differential equations describing the system in the assumed models. Author

N73-19058*# Life Systems, Inc., Cleveland, Ohio.
REGENERATIVE FUEL CELL STUDY Final Report
R. A. Wynveen and F. H. Schubert Dec. 1972 61 p refs
(Contract NAS9-12509)
(NASA-CR-128848; LSI-ER-151-2) Avail: NTIS HC $5.25 CSCL 10A

The completion of the study is reported for the regenerative fuel cell subsystem (RFCS) as an energy storage process for use aboard the space shuttle launched modular space station (MSS). The MSS mission requirements, and RFCS are discussed, and a comparison between RFCS and a nickel cadmium battery subsystem is presented. Development costs are also discussed. F.O.S.

N73-19059*# Ohio State Univ., Columbus. Electronic Materials and Devices Lab.
EFFECTS OF POSITIVE ION IMPLANTATION INTO ANTI-REFLECTION COATING OF SILICON SOLAR CELLS Final Report
A. E. Middleton, J. W. Harpster, W. J. Collis, and C. K. Kim 24 Jun. 1971 150 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953042)
(NASA-CR-131090) Avail: NTIS HC $9.50 CSCL 10A

The state of technological development of Si solar cells for highest obtained efficiency and radiation resistance is summarized. The various theoretical analyses of Si solar cells are reviewed. It is shown that factors controlling blue response are carrier diffusion length, surface recombination, impurity concentration profile in surface region, high level of surface impurity concentration (degeneracy), reflection coefficient of oxide, and absorption coefficient of Si. The theory of ion implantation of charge into the oxide antireflection coating is developed and side effects are discussed. The experimental investigations were directed at determining whether the blue response of Si solar cells could be improved by phosphorus ion charges introduced into the oxide antireflection coating. Author

N73-19060*# Gould, Inc., Mendota Heights, Minn. Energy Technology.
NON-GASSING NICKEL-CADMIUM BATTERY ELECTRODES AND CELLS: TESTING OF 25 Ah CELLS Supplementary Report, 25 Aug. 1972 - 25 Nov. 1972
E. Luksha and D. J. Gordy 23 Feb. 1973 23 p ref Prepared for JPL
(Contracts NAS7-100; JPL-953184)
(NASA-CR-130932; Rept-712-122-5) Avail: NTIS HC $3.25 CSCL 10C

The testing of 30 practical size, experimental 25 ampere

hour cells constructed as part of an earlier negative limited cell development program is discussed. The test results showed that the negative limited cell is a possible means of developing a long-lived secondary cell. The cells were tested for 500 cycles using an accelerated regime approximating a 90-minute orbit period. Three groups of ten cells were tested at 0,25, and 40 C. The cycle data showed that the negative limited cells had higher degradation rates at the higher operating temperatures. At the conclusion of 500 cycles, the three groups had average capacities of 16.83, 12.74, and 5.71 ampere hours for testing at 0, 25, 40 C, respectively. The conditioning capacities of these cells was in the 25 ampere hours range. The internal cell pressures of the three groups was also temperature dependent and was, in general, in the 2 psig range during the course of the test program. No periodic variation of the internal pressure with the state-of-charge was observed except with some cells tested at 40 C.
Author

N73-19061# Argonne National Lab., Ill.
DEVELOPMENT OF HIGH-SPECIFIC-ENERGY BATTERIES FOR ELECTRIC VEHICLES Progress Report, Feb. - Jul. 1972
E. J. Cairns, E. C. Gay, R. K. Steunenberg, H. Shimotake, J. R. Selman, T. L. Wilson, and D. S. Webster Sep. 1972 114 p refs
(Contract W-31-109-eng-38)
(ANL-7953) Avail: NTIS

The technology required to construct secondary batteries having the performance capabilities required for pollution free electric automobiles is discussed. Batteries for this application should have an energy storage capability of 220 W/kg. Their cost should not exceed about $10/KW-hr of energy storage capability. Lithium/sulfur cells using a molten lithium halide-containing electrolyte and operating at 360 to 390 C have achieved capacity densities of up to 0.9 A-hr/sq cm (above 1 V) at a current density of 0.9 A/sq cm with a cycle life of more than 2000 cycles during 7000 hr of operation. The enclosed mixed-cathode Cell L-9 had a cycle life and lifetime of 150 cycles and 1000 hr, respectively, with a capacity density up to 0.4 A-hr/sq cm at a current density of 0.24 A/sq cm to a 1.0-V cutoff. These results are consistent with the specific energy and specific power goals, but the cycle life and the sulfur electrode performance require further improvement. Author

N73-19062# Naval Ship Research and Development Center, Annapolis, Md.
A DISCUSSION OF ELECTROLYTE AND PRODUCT MANAGEMENT IN HYDRAZINE-OXYGEN FUEL CELLS UNDER CYCLIC PRESSURE: A PHASE REPORT
H. B. Urbach, R. J. Bowen, and D. E. Icehower Dec. 1972 26 p refs
(AD-753802; NSRDC-27-236; NSRDC-3902) Avail: NTIS CSCL 10/2

Fuel-cell power systems proposed for underwater applications may be categorized according to the method of adaptation to the hydrostatic pressure environment, namely a pressure-equilibrated or an encapsulated concept. The pressure-equilibrated concept is attractive in systems using liquid reactants because it eliminates requirements for the any hard containment vessel with its significant weight penalty. In the report, an attempt is made to interpret hydrazine fuel-cell performance and to resolve fuel-cell problems arising from operation in dynamic pressurized environments as they relate to fuel-cell design. GRA

N73-19063# Army Foreign Science and Technology Center, Charlottesville, Va.
HIGH-TEMPERATURE IMPREGNATION OF SINTERED-METAL ALKALINE-BATTERY ELECTRODES
Yu. N. Pervushin and M. F. Skalozubov 22 Jun. 1972 7 p refs Transl. into ENGLISH from Tr. Novocherk. Politekhn. Inst. (Novocherkassk), v. 190, 1969 p 96-100
(AD-754257; FSTC-HT-23-823-72) Avail: NTIS CSCL 10/3

Sintered-metal Cd-Ni electrodes for alkaline batteries are difficult to make because of the low efficiency of the liquid process used on the sintered-metal alloy. Impregnation of the sintered metal may be increased in two ways: By increasing the active-metal concentration in the impregnating solution, which increases the weight of nickel hydroxide due to physical filling of the pores, and by increasing the dissolution rate of the sintered metal, which increases the Ni(OH)2 weight due to hydroxide formation in the pores. The proposed method of high-temperature impregnation of sintered metal under excess vapor pressure eliminates the disadvantages of soaking in highly concentrated solution and accelerates the impregnation process simultaneously in the two ways mentioned above. GRA

N73-19981* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
DEVELOPMENT OF A THICK-FILM SILICON RIBBON GROWTH TECHNIQUE FOR APPLICATION TO LARGE-AREA SOLAR CELLS AND ARRAYS
P. A. Berman *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 44-52 refs (For availability see N73-19975 10-34) CSCL 10A

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-19064*# Indiana Univ., Bloomington. School of Medicine.
CONTROL MECHANISMS IN PHYSIOLOGICAL RHYTHMS
Sherwin Mizell 8 Jan. 1973 3 p refs
(Grant NGR-15-003-053)
(NASA-CR-131153) Avail: NTIS HC $3.00 CSCL 06P

A search was made for the factors involved in regulating rhythmic body functions. The basic premise was that at a particular point in time, any cell can normally act in one of two ways. It can either be engaged in dividing or carrying out its particular function. Experimental results indicate rhythmic functions are controlled by a lighting regime and that an inverse correlation exists between rhythms of cell division and cell function. Data also show rhythms are a function of animal sex and environment. E.H.W.

N73-19065# Advisory Group for Aerospace Research and Development, Paris (France).
COLOUR VISION REQUIREMENTS IN DIFFERENT OPERATIONAL ROLES
Nov. 1972 83 p refs In ENGLISH; partly in FRENCH Presented at AGARD Aerospace Med. Panel Specialist Meeting, Brussels, 30 May 1972
(AGARD-CP-99) Avail: NTIS HC $6.25

Proceedings are presented on the theoretical and practical aspects of color vision, the rationale of color vision requirements for air and ground crews, and color vision testing. The requirements for flying personnel of the armed forces for many nations are emphasized. For individual titles, see N73-19066 through N73-19076.

N73-19066* Duke Univ., Durham, N.C. Dept. of Ophthalmology.
THEORETICAL ASPECTS OF COLOR VISION
Myron L. Wolbarsht *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 10 p refs (For availability see N73-19065 10-04)
(Contract NAS9-11994)

The three color receptors of Young-Helmholtz and the opponent colors type of information processing postulated by Hering are both present in the human visual system. This mixture accounts for both the phenomena of color matching or hue discrimination and such perceptual qualities of color as the division of the spectrum into color bands. The functioning of the cells in the visual system, especially within the retina, and the relation of this function to color perception are discussed. Author

N73-19067 Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany). Opthalmological Branch.
PRACTICAL ASPECTS OF COLOR VISION AND ITS DISTURBANCES
Dietrich Kuerschner *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 8 p refs (For availability see N73-19065 10-04)

A number specialities of the German Air Force, except the flying personnel, were assessed to determine the extent of color

vision required. It is shown that normal color vision is mandatory only for the activities of the telephone technician and the telephone construction technician. Author

N73-19068 Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France).

EXAMINATION OF CHROMATIC SENSE IN FRENCH AERIAL FORCES [L'EXAMEN DU SENS CHROMATIQUE DANS LES FORCES AERIENNES FRANCAISES]

G. Perdriel and J. Chevaleraud *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 5 p In FRENCH (For availability see N73-19065 10-04)

A procedure was developed to test the chromatic aptitude of dyschromatopsia victims who wanted positions as navigators or pilots in France. Security procedures using such personnel and a color signaling process to aid them in perceiving colors are discussed. Transl. by E.H.W.

N73-19069 School of Aerpspace Medicine, Brooks AFB, Tex. Ophthalmology Branch.

HISTORY, RATIONALE, AND VERIFICATION OF COLOR VISION STANDARDS AND TESTING IN THE UNITED STATES AIR FORCE

Thomas J. Tredici, James L. Mims, III, and James F. Culver *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 10 p refs (For availability see N73-19065 10-04)

The color vision testing and selection procedures utilized in World War II by the US Army Air Corps are reviewed. The color vision standards for flying in the US Air Force recently were changed for the first time since World War II. Mild defectives scoring 50 or better on the SAM color threshold tester are now accepted into flying training. A ten-year retrospective study of 4801 experienced flying personnel provides strong evidence that these standards are valid. The handling of color vision defective cases is also outlined. Author

N73-19070 National Defence Medical Centre, Ottawa (Ontario). Dept. of Ophthalomology.

COLOUR VISION IN THE CANADIAN ARMED FORCES

Bryan St. L. Liddy *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 6 p (For availability see N73-19065 10-04)

Color vision in the Canadian Armed Forces is reviewed, including their standard tests: Ishihara standards book test, Green Edwards lantern test, and A.O. isochromatic book test. Different requirements of color vision for the various service branches are described. Minimum color vision standards for the initial assignment to trades within the armed forces are listed in tabular form. J.A.M.

N73-19071 Centre de Medecine Aeronautique, Brussels (Belgium).

STANDARDIZATION OF TEST AND CATEGORIZATION OF COLOR VISION ANOMALIES IN MILITARY CIRCLES, AND METHODS USED BY EMPLOYEES TO TRACK DOWN THEIR PROBLEMS [ESSAI DE STANDARDISATION DE LA CATEGORISATION DES ANOMALIES DE LA VISION DES COULEURS EN MILIEU MILITAIRE, AINSI QUE DES METHODES EMPLOYEES EN VUE DE LEUR DEPISTAGE]

J. M. VanDeCasteele *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 4 p In FRENCH (For availability see N73-19065 10-04)

Sound scientific procedures developed to categorize color vision abnormalities in a uniform manner are discussed. The classification of individuals was made as a function of the number of error responses to tests, the nature of the abnormality and the gravity of the condition. Transl. by E.H.W.

N73-19072 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

COLOUR VISION REQUIREMENTS IN DIFFERENT OPERATIONAL ROLES

D. H. Brennan *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 8 p refs (For availability see N73-19065 10-04)

Color vision in the various operational roles of the Royal Air Force and Army Air Corps was studied. It is considered that good color acuity, although playing a valuable part in the total process of visual perception, is not of paramount importance. It would be possible by altering the present chromaticities of red and green signal colors to admit for all aircrew duties, except those of close air support, the more severe grades of red green defective. It is thought, however, that the small gain in recruiting would not warrant the resulting expense and disruption of present services. The pseudo-isochromatic plates provide a simple and rapid method of detecting even minor anomalies of color vision. With present standards, the lantern is the best trade test for grading color defectives as fit or unfit for aircrew duties. Should standards be lowered it would be necessary to supplement the lantern with a quantitative test which should be related, if possible, to the role envisaged for the candidate. Author

N73-19073 Army Aeromedical Research Lab., Fort Rucker, Ala.

AIRCREW COLOR VISION REQUIREMENTS

Robert W. Bailey *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 4 p (For availability see N73-19065 10-04)

A study revealed no statistical difference in accident rates between a selected population of color defectives and a matched sample of normals. The only significant difference demonstrated was between serious accidents in which the color normals were involved in a greater number of accidents (statistically significant) than color defectives. Operational testing of difficult cases are also presented. Author

N73-19074 Walter Reed Army Medical Center, Washington, D.C.

PREDICTING VISUAL PERFORMANCE IN AVIATORS (COLOR VISION)

Budd Appleton *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 5 p (For availability see N73-19065 10-04)

The whole concept of physical standards for personnel selection is reviewed, emphasizing visual performance for aviators. Color vision tests as predictive indicators of flying task performance are evaluated. Experience with a battery of tests as part of an aeromedical in-flight evaluation is recorded in tabular form for 12 aviators. J.A.M.

N73-19075 Headquarters Army Aviation, Middle Wallop (England). Dept. of Aviation Medicine.

HELICOPTER FLYING AND COLOUR VISION

I. C. Perry *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 4 p refs (For availability see N73-19065 10-04)

When problems are encountered in low level helicopter flying, under poor light and in featureless terrain, difficulties arise where colors have to be used for information presentation and to isolate certain items of information. Instrument lighting, map colors and marking can all become problem areas when the operators color vision is abnormal. Differences are found in methods of color vision testing. The use of colored smokes against varying backgrounds can lead to mistakes, as can wiring diagrams and wire markings. Author

N73-19076 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

COLOR VISION REQUIREMENTS FOR AIR CREW PERSONNEL OF THE FUTURE

Walter F. Grether *In* AGARD Colour Vision Requirements in Different Operational Roles Nov. 1972 7 p refs (For availability see N73-19065 10-04)
(AMRL-TR-71-116)

Color has unique value as a means of coding visually presented information. This was shown by experimental evaluations of alternate coding methods, such as pattern, size, intensity and flash rate. A reduction in color vision selection standards for flight personnel, such as the pilot, would require the replacement of color with other and potentially less efficient visual coding methods. Such a change would restrict the visual display choices available to the designers of future information presentation equipment, both airborne and ground. An examination of past trends and current equipment development indicates that the use of color for coding information used by flight personnel

will probably be increasing rather than decreasing in the future.
Author

N73-19077*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF SPACE BIOLOGY, VOLUME 16
V. N. Chernigovskiy, ed. Washington NASA Feb. 1973 427 p refs Transl. into ENGLISH of the book "Problemy Kosmicheskoy Biologii, Volume 16" Nauka Press, Moscow, 1971 427 p
(Contract NASw-2037)
(NASA-TT-F-719) Avail: NTIS HC $6.00 CSCL 06C

Medico-biological studies of the action of diverse space flight factors on the organisms of man and animals are reported with emphasis on overloads and hyperkinesia. The importance of optimum gas atmosphere selection for humans in enclosed spaces is considered. For individual titles, see N73-19078 through N73-19121.

N73-19078* Techtran Corp., Glen Burnie, Md.
REACTIVITY OF AN ORGANISM IN CONDITIONS OF PROLONGED SPACEFLIGHT
P. V. Vasilyev *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 3-11 refs Presented at the 3d Intern. Symp. on the Basic Probl. of Human Life in Space, Geneva, Nov. 1968 (For availability see N73-19077 10-04)
CSCL 06C

It was determined that weightlessness and hypodynamia lead to functional reorganization of the organs of circulation, respiration, and excretion, analyzers, regulatory systems of the organism, as well as different kinds of metabolism. Data show that under the effect of weightlessness and hypodynamia the orthostatic and vestibular stabilities decrease, sensitivity to infections increases, resistance to accelerations and physical stress decreases, and reaction to medication changes. Author

N73-19079* Techtran Corp., Glen Burnie, Md.
CERTAIN RESULTS OF MEDICAL INVESTIGATIONS ABOARD THE VOSKHOD-2 SPACECRAFT
I. I. Kasyan, D. G. Maksimov, I. G. Popov, V. G. Terentyev, L. S. Khachaturyants, and G. F. Khlebnikov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 12-28 refs (For availability see N73-19077 10-04)
CSCL 06E

During flight in the Voskhod-2 spacecraft it was found that reaction of the cardiovascular and respiratory systems in the pre-launch period and during the majority of the stages of the orbital flight did not differ substantially from observations in preceding flights. The frequency of heart contractions and respiration rose in the cosmonauts by only 1.5-2 times during the launching. Clinical examinations for three days after the flight showed an increase in reaction of the cardiovascular system to orthostatic tests and physical loads. Electrocardiographic examination revealed slowing down of intragastric conductivity and increase of the systolic index. EEG analysis showed reinforcement of sluggish activity. Author

N73-19080* Techtran Corp., Glen Burnie, Md.
STUDY OF FEATURES OF HIGH INTENSITY NOISE EFFECTS DURING SPACEFLIGHT
Ye. M. Yuganov, Yu. V. Krylov, and V. S. Kuznetsov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 29-33 refs (For availability see N73-19077 10-04)
CSCL 06S

Experiments were performed to study the effect on man of high intensity noises whose frequency range, length and volume corresponded to the conditions of the active period of spaceflight. The effect of 125-126 and 114-116 db of noise on the auditory and motor analyzers, and also on the condition of the pulse and blood pressure of 24 subjects was studied in 105 experiments during exposure for 20 minutes. It was found that noise at 125-126 db during the given exposure time causes unfavorable reactions on the part of the above mentioned indices. It was concluded that there is no danger from noise at 114-116 db for 20 minutes, considering the demands and particular features of spaceflight. Author

N73-19081* Techtran Corp., Glen Burnie, Md.
EFFECT OF IMMERSION ON CERTAIN MOTOR FUNCTION INDICES
A. A. Korobova, A. V. Ovsyannikov, G. G. Ratishvili, and A. V. Korobkov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 34-48 refs (For availability see N73-19077 10-04)
CSCL 06S

Indices of a simple movement with visual adjustment and without it, and also a determination of the peculiarities of the functional state of the segmentary apparatus of the spinal column during the period of organization of voluntary movements of man during prolonged stay in a physiological solution are reported. Reduction of the threshold value of the H-reflex during a three to four day stay in conditions of immersion is seen as a consequence of the increase of reflector excitability of alpha-motor neurons of the spinal column. Comparative evaluation of execution of a motor problem with visual adjustment and without it shows shifts during shut-off of the visual adjustment both in background examinations and after immersion on all days of recovery. The immersion medium has a different effect on the postural tonic and phase musculature, and correspondingly also on the nature of execution of motor acts. Author

N73-19082* Techtran Corp., Glen Burnie, Md.
BASAL METABOLISM UNDER CONDITIONS OF SIMULATED WEIGHTLESSNESS
V. I. Sokolkov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 49-55 refs (For availability see N73-19077 10-04)
CSCL 06S

The effect of twenty-four hours' water immersion on the level of basal metabolism and certain functions of external respiration of man was studied. Under conditions of water immersion the indices of basal metabolism of the consumption of oxygen, of elimination of carbon dioxide, pulmonary ventilation and the coefficient of the use of oxygen are higher than under conditions of staying in bed. This confirms that models of weightlessness, such as hypodynamia (bed conditions) and water immersion lead to different levels of metabolisms. Author

N73-19083* Techtran Corp., Glen Burnie, Md.
CHANGE IN THE CAPACITY OF MAN TO WITHSTAND TRANSVERSE STRESSES AFTER HYPODYNAMIA OF VARYING DURATION
A. R. Kotovskaya, R. A. Vartbaronov, and S. F. Simpura *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 56-65 refs Presented at the 18th Congr. of the Intern. Astronautical Federation, Belgrade, 25-30 Sep. 1967 (For availability see N73-19077 10-04)
CSCL 06S

The capacity of man to withstand transverse stresses after hypodynamia was studied. Gradual reduction in the resistance to the action of maximum stresses was detected at time periods of hypodynamia from 7 to 15-20 hours. Later resistance to stresses was preserved approximately at the same level up to the 60th hour of hypodynamia. Similar shifts were obtained in a study of the reactivity of the cardiovascular and breathing systems to stresses determined by the level of pulse strain and increase of pulmonary ventilation before and after hypodynamia of varying duration. The results obtained give a basis for supposing the existence of a second phase (stabilization) in the development of a unique adaptation to conditions of hypodynamia. Author

N73-19084* Techtran Corp., Glen Burnie, Md.
CHANGE IN CERTAIN INDICES OF THE FUNCTION OF EXTERNAL RESPIRATION DURING THE ACTION OF G-FORCES
S. F. Simpura *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 66-79 refs (For availability see N73-19077 10-04)
CSCL 06S

In studies on human beings dynamics of changes in the basic indices of the function of external respiration during the action of spike-like type transverse g-forces were studied. Shifts in the systems of respiration and gas exchange during the action of spike-like type g-forces confirm the disturbance of the oxygen balance. Disturbance to the rhythm of respiration under g-forces of up to 13 units did not cause significant shifts in the functions of respiration and gas exchange; during g-forces of higher than 13 units (up to 16 units) there was a marked decrease in the effectiveness of ventilation and gas exchange in lungs. Author

N73-19085* Techtran Corp., Glen Burnie, Md.
EFFECT OF ACCELERATIONS ON REACTIVITY OF THE GASTRO-INTESTINAL TRACT TO PHARMACOLOGICAL AGENTS
P. V. Vasilyev, I. G. Krasnykh, V. Ye. Potkin, and L. A. Tyutin *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 80-86 refs (For availability see N73-19077 10-04)
CSCL 06S

In roentgenographic experiments on white rats, the effects of transversely oriented accelerations on reactivity of an organism to pharmacological agents which act primarily on the gastro-intestinal tract were studied. A change is observed in the sensitivity of the rats to the action of acetylcholine and carbocholine for a period of five minutes after accelerations having a value of twenty. Author

N73-19086* Techtran Corp., Glen Burnie, Md.
CHANGES IN THE NUCLEI OF LIVER CELLS DURING THE ACTION OF TRANSVERSE STRESSES ON ANIMALS
Ye. F. Kotovskiy and G. A. Kosolapov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 87-92 refs (For availability see N73-19077 10-04)
CSCL 06C

A karyometric study of the nucleus of liver cells of intact white rats and rats subjected to the action of stresses was performed with a value of 25 units for 10 minutes in the direction of chest-back. A reduction in the volume of the nuclei and the nucleoli one and two hours after the action of stresses was found. There was reduction in the amount of nuclei of class K sub 3 six and seven hours after the action of stresses, but there was an increase in the number of large nuclei of classes K sub 4 and K sub 8. Simultaneously the mitotic activity increased by eight to nine times and the amounts of small nuclei of class K sub 1 increased. A slight hemorrhaging in the liver which caused destruction of sections of the parenchyma was noticed. Author

N73-19087* Techtran Corp., Glen Burnie, Md.
PROBLEM OF THE INTERACTION OF ANALYZERS AND DEGREE OF VESTIBULAR REACTIONS TO THE ACTION OF EXTERNAL STIMULI
S. S. Markaryan *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 93-113 refs (For availability see N73-19077 10-04)
CSCL 06C

Investigations on human test subjects in order to determine the efficiency of certain methods of inhibiting illusory sensations and postrotational nystagmus based on the action of sound, light and proprioceptive stimuli were conducted. The data obtained show that the action of light of varying intensity causes inhibition of vestibular nystagmus while the duration of the illusion of counter-rotation remains almost unchanged. During the action of sound with a frequency of 1,000 Hz and intensity of 100-110 db the duration of the illusion of counter-rotation is abbreviated and the amplitude and duration of post-rotational nystagmus are reduced. Muscle forces which are developed during manual and especially during postural dynamometry shorten the length of the illusion of counter-rotation, and shortening of the length of the illusion becomes more pronounced along with an increase of the muscular forces. Author

N73-19088* Techtran Corp., Glen Burnie, Md.
CONDITION OF THE VESTIBULAR ANALYZER IN DOGS AFTER PROLONGED IRRADIATION IN SMALL DOSES
P. I. Kumets *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 114-119 refs (For availability see N73-19077 10-04)
CSCL 06C

The functional condition of the vestibular analyzer in sixty dogs, some of which were subjected to continuous radiation action in overall doses of 25-225 rads/year were evaluated. Six dogs were given medical preventive agents. Quantitative evaluation of the functional conditions of the vestibular analyzers showed an increase in excitability of the spatial analyzer by 35-40% in animals which had been irradiated with a total dosage of 225 rads/year. Observed is a tendency towards decrease of excitability and increase of reactivity in the group of animals which had been irradiated with a dose of 225 rads/year and which had received medical preventive agents. Author

N73-19089* Techtran Corp., Glen Burnie, Md.
CONDITION OF METABOLISM DURING PROLONGED STAY OF MAN IN A SMALL ENCLOSURE WITH CYCLICALLY CHANGING ATMOSPHERE
I. G. Popov, Yu. K. Syzrantsev, P. P. Lobzin, I. A. Romanova, S. A. Bugrov, and R. V. Kudrova *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 120-132 refs (For availability see N73-19077 10-04)
CSCL 06S

Nitrogen and water-salt metabolisms in two test subjects who stayed for 35 days in a small enclosure with a cyclically changing atmosphere were studied. There is a tendency to reduction of negative nitrogen balance during the action of hypoxic gas mixtures with some excess of carbon dioxide which probably is conditioned by the increase in activity of the respiratory muscles. At this time a change in the structure of the water metabolism is noted. Author

N73-19090* Techtran Corp., Glen Burnie, Md.
CONDITIONS OF ASCERTAINING AND CONDITIONING MAN'S CAPACITY TO DISTINGUISH THE COMPOSITION OF A BREATHING ATMOSPHERE
I. S. Breslav, A. G. Zhironkin, and A. M. Shmeleva *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 133-144 refs (For availability see N73-19077 10-04)
CSCL 06S

The capability of man to distinguish changes in the composition of inhaled air has been studied. Man's ability to distinguish changes in the composition of gas mixtures improved under conditions of a constant (fixed) level of pulmonary ventilation. An individual variability of reactions in different people to hypoxic and hypercapnic environments was noted. During repeated exposures to different respiratory mixtures man can more clearly differentiate between these mixtures according to his sensations. Thus, the ability of man to distinguish definite changes in the amount of separate components of breathed air according to his sensations may be improved. Author

N73-19091* Techtran Corp., Glen Burnie, Md.
EFFECT OF HYPEROXIC MEDIUM ON CELLS, TISSUES AND ORGANS OF EXPERIMENTAL ANIMALS
Ye. F. Kotovskiy and L. L. Shimkevich *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 145-158 refs (For availability see N73-19077 10-04)
CSCL 06S

Data on the general morphology, ultrastructure and histochemistry of various organs of experimental animals during hyperoxia are reviewed. Basically, information is presented on the effect of 100% O2 at normal barometric pressure. Oxygen damages the vascular wall by eosinophilic infiltration of tissues and has a pronounced action on the condition of the ultrastructure and metabolism of cells. Initially there is activation of metabolisms of cells without visible morphological changes. This period (6 hours) is considered on the whole as harmless for the organism. Later (after 12 hours) phenomena of a pathological nature arise. A compensatory increase in the activity of glycolytic enzymes ensures following the appearance of secondary hypoxia in tissues. Author

N73-19092* Techtran Corp., Glen Burnie, Md.
ACTION OF HYPEROXIA ON CONNECTIVE TISSUE
L. L. Shimkevich *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 159-167 refs (For availability see N73-19077 10-04)
CSCL 06S

A general morphological, electron microscopic and cytochemical study of subcutaneous connective tissue of white rats while keeping them under conditions of increased partial pressure of oxygen was conducted. A short term action of pure oxygen at 1 ata caused activation of metabolism in the connective tissue cells without disturbance of ultrastructures. Noticeable pathological changes arose after twelve hours, later they advanced and appeared as destruction of cellular organelles, as suppression of cellular metabolism, and partially as a reduction in the activity of the oxidative enzymes. Destructive changes of collagenic fibers were noticed. Data are also presented on the structure and cytochemistry of connective tissue under other conditions of hyperoxia. Author

N73-19093* Techtran Corp., Glen Burnie, Md.
GAS EXCHANGE AND ELECTRICAL ACTIVITY OF THE SKELETAL MUSCULATURE OF ANIMALS IN A HELIUM AND OXYGEN MEDIUM
G. V. Troshikhin *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 168-174 refs (For availability see N73-19077 10-04)
CSCL 06C

The gas exchange electrical activity of the skeletal musculature (EAM) -- the heat regulating tonus, and the rectal temperature for rats which were kept for one hour in the air, in a helium-oxygen mixture and again in air, were studied. Animals kept in the helium-oxygen atmosphere at room temperature showed a definite increase in the level of gas exchange, an increase of the EAM, and a drop in rectal temperature. Transition to air respiration brought about normalization of almost all the functions. Increasing the temperature by 5 deg (25-27 deg) in comparison with that of air (20-22 deg) led to a small decrease of EAM indices, gas exchange, and body temperature. Author

N73-19094* Techtran Corp., Glen Burnie, Md.
STUDY OF THE PHYSIOLOGICAL EFFECT OF REPLACING ATMOSPHERIC NITROGEN IN THE AIR WITH INERT GASES UNDER CONDITIONS OF OXYGEN INSUFFICIENCY AND INCREASED CONCENTRATIONS OF CARBON DIOXIDE
M. M. Osipova and A. G. Dianov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 175-180 refs (For availability see N73-19077 10-04)
CSCL 06K

In experiments with rats it is shown that replacing atmospheric nitrogen with argon in hermetically enclosed chambers at -22 C does not affect the basic physiological functions and longevity of the animals. This confirmed the supposition that an increase of longevity of animals in hermetically enclosed chambers with a helium-oxygen atmosphere is determined by the high thermal conductivity of helium in comparison with nitrogen. Author

N73-19095* Techtran Corp., Glen Burnie, Md.
POSSIBILITY OF USING ADAPTATION OF HYPOXIC HYPOXIA IN A SYSTEM OF CONDITIONING
A. V. Yeremin, A. N. Azhayev, V. I. Stepantsov, P. V. Buyanov, V. S. Formin, and D. Yu. Arkhangelskiy *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 181-187 refs (For availability see N73-19077 10-04)
CSCL 06P

The possibility of conditioning to increase human resistance to certain extreme factors was studied. Three series of investigations were conducted: The first at an altitude of 4,000 m with optimum air temperature; the second at an altitude of 4,000 m with high air temperature; and the third at an altitude of 2,000 to 5,000 m with changing physical stress at an optimum air temperature. Length of the conditioning cycle was twenty days. Results of the investigation showed that the third series of conditioning was the most effective for increasing resistance to high temperatures, transversely oriented stresses, and vestibular-optical-kinetic stimuli. Author

N73-19096* Techtran Corp., Glen Burnie, Md.
EFFECT OF CERTAIN GASEOUS TOXIC SUBSTANCES ON THE RESISTANCE OF ANIMALS TO ACUTE HYPOXIC HYPOXIA
B. I. Abidin, N. M. Asyamolova, and A. K. Sgibnev *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 188-198 refs (For availability see N73-19077 10-04)
CSCL 06T

The effect of different concentrations of a mixture of gaseous chemical substances on the ability of animals to withstand acute hypoxic hypoxia is examined. Comparative data of the change in EEGs, EKGs, and respiration of inoculated and intact rats under conditions of rarefied atmosphere, which corresponds to an elevation of 10,000 m are analyzed. Gaseous chemical substances change the relationship of the organism of animals to the influence of hypoxic hypoxia, reduce the physiological ceiling, and increase the ability to withstand acute oxygen deficiency. Author

N73-19097* Techtran Corp., Glen Burnie, Md.
CERTAIN PECULIARITIES OF THE BIOLOGICAL ACTION OF GASEOUS TOXIC SUBSTANCES WHICH ARE DISCHARGED INTO THE ATMOSPHERE FROM THE URINE AND FECES
V. V. Kustov, V. I. Mikhaylov, and L. T. Poddubnaya *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 199-205 refs (For availability see N73-19077 10-04)
CSCL 06T

In tests on white rats it was determined that a variety of gaseous toxic substances which enter the air from fresh and stored excrement has not only an irritating but also a generally toxic action. Author

N73-19098* Techtran Corp., Glen Burnie, Md.
EFFECT OF A CHEMICAL PRESERVATIVE ON THE INTENSITY OF THE DISCHARGE OF CERTAIN GASEOUS TOXIC SUBSTANCES FROM STORED URINE
L. T. Poddubnaya, L. N. Rogatina, V. V. Kustov, and V. I. Mikhaylov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 206-209 refs (For availability see N73-19077 10-04)
CSCL 06T

The effect of a chemical preservative from a class of phenols on the intensity of gas discharges from stored urine was studied. It was determined that addition of a preservative reduces the entrance of substances of a group of ammonia, ketones, fatty acids and nitrogen oxides into the air. In addition the discharge of carbon monoxide and organic compounds, as determined by the total amount of carbon, did not change. Author

N73-19099* Techtran Corp., Glen Burnie, Md.
PRESERVATION OF URINE IN A SYSTEM FOR REGENERATION OF WATER FROM IT c05
L. N. Rogatina, A. M. Karagodina, and V. A. Panchenko *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 210-215 (For availability see N73-19077 10-04)
CSCL 06K

Thirty-two substances and their combinations for the preservation of urine during storage for two weeks at 18-20 deg were studied. Five prescriptions were also studied for regeneration of water from urine. During the preservation of the urine a reduction was noted in the amount of ammonia and organic substances in the condensate. The condensate corresponded to standard requirements for drinking water for the amount of microorganisms, transparency and odor. A small amount of preliminary purification of the condensate on ion exchange resins was required in order to obtain water which corresponds to requirements for drinking water based on physical-chemical indices. Author

N73-19100* Techtran Corp., Glen Burnie, Md.
THE RESISTANCE OF ANIMALS TO TOXIC ACTION OF CERTAIN GASES AFTER ADAPTATION TO HYPOXIA
G. A. Vasilyev, L. A. Tiunov, and V. V. Kustov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 216-222 refs (For availability see N73-19077 10-04)
CSCL 06S

In tests of white rats the resistance of animals which had been adapted to hypoxia and to the the toxic action of carbon monoxide, nitrogen oxide, triethylamine and Freon-12 is studied. Preliminary adaptation of the animals to hypoxia increases their resistance to acute poisoning by carbon monoxide, nitrogen oxides and Freon-12 and does not change the sensitivity of the mice to the toxic action of triethylamine. It is assumed that adaptation of the animals to hypoxia may substantially increase the resistance to the toxic action of poisons which disturb the oxygen balance in an organism. Author

N73-19101* Techtran Corp., Glen Burnie, Md.
THE TOXIC ACTION OF GASEOUS PRODUCTS OF THE VITAL ACTIVITY OF AN ORGANISM
T. S. Kolosova, L. A. Tiunov, V. V. Kustov, L. V. Ivanova, G. A. Vasilyev, G. A. Lemesh, and M. A. Akhmatova *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 223-232 refs (For availability see N73-19077 10-04)
CSCL 06T

The peculiarities of the biological action of a group of gaseous products of the vital activity of white rats in twenty-six day experiments were studied. It was established that this group of

chemical substances causes damage to the pulmonary tissue and development of anemia in the experimental animals, and leads to an increase in oxygen consumption, increase in weight of the thyroid gland, inhibition of the growth of the experimental rats, and changes in the catalase activity of the blood. Author

N73-19102* Techtran Corp., Glen Burnie, Md.
PROBLEM OF STUDYING THE TOXICITY OF INDOLE
A. K. Sgibnev and T. A. Orlova *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 233-239 refs (For availability see N73-19077 10-04)
CSCL 06T

Inhalation of indole vapors in a concentration of 9.0 to 10.0 mg/cu m for two to three hours causes no substantial changes in the organism of mice, rats and rabbits. After intravenous injection of rabbits with 10.0 mg of an alkaline solution of indole the latter is quickly rendered harmless and expelled from the organism. The threshold for perception of the unpleasant odor of indole is 0.45 mg/cu m. Inhaling the indole vapors in the concentration of more than 1.0 mg/cu m may lead to negative subjective sensations: headache, nausea. Author

N73-19103* Techtran Corp., Glen Burnie, Md.
PROBLEM TO TOXICITY OF EXHALED AIR
V. V. Kustov, L. T. Poddubnaya, and V. I. Mikhaylov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 240-243 refs (For availability see N73-19077 10-04)
CSCL 06T

Peculiarities of the biological action of air, exhaled by man, were studied in tests on white mice. It was determined that a group of gaseous toxic substances contained in exhaled air cause neural humoral shifts in an organism which involve a certain intensification of the inhibiting reaction in the nervous system. Author

N73-19104* Techtran Corp., Glen Burnie, Md.
PECULIARITIES OF DETERMINING THE OXIDIZABILITY OF WATER DURING ITS REGENERATION c05
V. A. Kryuchkov and N. S. Mareyeva *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 244-253 refs (For availability see N73-19077 10-04)
CSCL 06K

The completeness of oxidation of organic impurities in the condensate of the atmospheric vapors of an inhabited cabin was studied. All of the errors which were determined were analyzed. A conclusion of the possibility of using a different method of determination of oxidizability for the analysis of the regenerated water was provided. These methods have been developed for ground waters, stagnant waters and other waters. Author

N73-19105* Techtran Corp., Glen Burnie, Md.
STUDY OF THE TECHNOLOGY OF DECONTAMINATION OF WATER WHICH HAS BEEN REGENERATED FROM THE LIQUID PRODUCTS OF HUMAN VITAL FUNCTIONS c05
V. A. Kryuchkov and L. I. Rogatina *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 254-261 refs (For availability see N73-19077 10-04)
CSCL 06K

Decontamination of water during its regeneration from products of the vital functions of man is considered. It has been shown that the starting products may contain a large quantity of microflora. In order to guarantee decontamination of the regenerated water the following technological procedures have been developed: conservation of urine, filtration of condensate of water through sorbents, and preparation of components of a system from materials which have antimicrobial properties. Author

N73-19106* Techtran Corp., Glen Burnie, Md.
EFFECT OF THE FREQUENCY OF CHANGING THE NUTRIENT SOLUTION ON PRODUCTIVITY OF PLANTS CULTIVATED ON KERAMZIT
I. V. Tsvetkova, V. P. Zamota, and E. V. Maksimova *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 262-279 refs (For availability see N73-19077 10-04)
CSCL 06A

Different time intervals for changing the nutrient solution in order to ensure its regeneration by the conservation of higher plants using the hydroponic method with a keramzit substrate are studied. Experimental data show that in order for the greenhouse to function at the given productivity within limits of a calculated theoretical data, the nutrient solution must be changed once in 90 days. Later use of the solution leads to an increase in the area needed by the greenhouse. The necessity of frequent regeneration of large amounts of nutrient solution and the high absorbing capacity of the substrate make possible its use in greenhouses with closed cycles. Author

N73-19107* Techtran Corp., Glen Burnie, Md.
CERTAIN INDICES OF THE MATERIAL BALANCE OF MAN AS A COMPONENT IN A CLOSED ECOLOGICAL SYSTEM
Ye. I. Pokrovskaya and A. P. Tereschchenko *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 271-279 refs (For availability see N73-19077 10-04)
CSCL 06P

The lack of stabilization in the process of elimination of elements from the human organism when kept on a constant diet is reported. The ratio of minimum and maximum amounts is 1:1.3-2.0. This regularity must be kept in mind when creating cultural media for autotrophic and heterotrophic organisms which are the separate units of biological-technological life support systems. The presence of a correlational relationship between certain elements when eliminating them from the organism along with the urine is weakened when different stress factors act on the organism. Author

N73-19108* Techtran Corp., Glen Burnie, Md.
STUDIES OF THE STABILITY OF THE CHEMICAL COMPOSITION OF A CHLORELLA BIOMASS DURING ITS PROLONGED CULTIVATION WITH RECOVERY OF THE MEDIUM ON NITRATES
Ye. K. Lebedeva, G. I. Meleshko, T. B. Galkina, and N. N. Yegorova *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 280-291 refs (For availability see N73-19077 10-04)
CSCL 06C

The chemical composition of a biomass remains sufficiently stable during prolonged cultivation of Chlorella with recovery of the medium. Variations in the amount of carbon and nitrogen in the biomass were respectively 1.5 and 5%, and the fluctuations of other basic elements did not exceed 10% of the average value. Fluctuations in the chemical composition were both spontaneous and related to cultivation conditions. Actual fluctuations of the chemical composition of a biomass, as a biological feature of the strain used, stay within a narrower range than fluctuations which are caused by cultivation conditions that are recorded during the test process. Author

N73-19109* Techtran Corp., Glen Burnie, Md.
USE OF PRODUCTS OF BIOLOGICAL MINERALIZATION FOR CULTIVATION OF HIGHER AND LOWER AUTOTROPHS
S. I. Tsitovich, I. V. Tsvetkova, M. I. Belyakova, V. F. Varlamov, V. P. Zamota, Ye. V. Maksimova, I. L. Chernovich, and V. N. Faleyeva *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 292-297 (For availability see N73-19077 10-04)
CSCL 06M

Data on the use of products of the vital functions of man which are mineralized by a biological method are reported. On the basis of these products nutrient solutions are made and subjected to biological tests using lime and higher autotrophs. Results show that the productiveness of the test plan does not differ from the control variants; the nutrient mixtures do not contain toxic substances, which means that they could be used with adjustments for cultivating higher and lower plants. Author

N73-19110* Techtran Corp., Glen Burnie, Md.
PROBLEM OF THE POSSIBILITY OF USING PRODUCTS OF THE VITAL FUNCTIONING OF MAN WHICH HAVE BEEN MINERALIZED BY THE WET BURNING METHOD c05
V. P. Zamota, I. V. Tsvetkova, E. V. Maksimova, A. L. Agre, B. G. Gusarov, and T. V. Nolde *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 298-305 refs (For availability see N73-19077 10-04)
CSCL 06K

Experimental data are reported on the raising of higher plants by the hydroponic method on a porous clay filter using fecal

masses which have been mineralized by the wet burning method. In the course of a year during the experiment, no reduction in the productivity of plants in dry and wet matter was noticed. The incompletely oxidized organic compounds of the mineralized products were not incorporated in the nutrient solution during the experiment but were absorbed by the substrate or completely mineralized by biological means and had no toxic effect on the plants. Author

N73-19111* Techtran Corp., Glen Burnie, Md.
PROBLEM OF MINERALIZATION OF VEGETATIVE WASTE PRODUCTS OF A BIOCOMPLEX BY THE METHOD OF THERMAL COMBUSTION c05
I. V. Tsvetkova, B. G. Gusarov, V. P. Zamota, Ye. V. Maksimova, and L. A. Filatkina *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 306-310 refs (For availability see N73-19077 10-04)
CSCL 06I

Carrying out the process of mineralization of waste products depends to a great extent on the specific peculiarities of the culture and the conditions of their cultivation. During cultivation of plants on aluminoferrosilicate heavy metals are washed away and accumulate in the root systems. The buildup of elements with changing valences has a catalytic effect during the use of the thermal combustion method. The greatest quantity of metals is built up in the economically nonuseful part of cabbage which brings about damage to the oxide film of the working surfaces of the burners. A number of requirements for earth burner devices in order to carry out thermal mineralization are necessary. Author

N73-19112* Techtran Corp., Glen Burnie, Md.
STUDY OF A METHOD OF CONSERVATION OF URINE RELATIVE TO SPACEFLIGHT CONDITIONS c05
V. V. Borshchenko, V. I. Vashkov, and L. N. Rogatina *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 310-316 refs (For availability see N73-19077 10-04)
CSCL 06K

Seven phenyl-containing substances were studied for purposes of conservation of urine during storage. The most effective seems to be the preparation called PNF. It easily dissolves in urine and assures its conservation for 100 days under normal conditions of a loss of 0.2 g per 100 ml of urine. The preparation PNF, included in the filler of a sanitation device, practically did not change the physical-mechanical properties of the latter but did give the filler an antimicrobial activity. Author

N73-19113* Techtran Corp., Glen Burnie, Md.
THE FOOD COMPONENT, BASED ON STORES OF DEHYDRATED PRODUCTS, IN LIFE SUPPORT SYSTEMS FOR CREWS OF SPACE VEHICLES DURING PROLONGED FLIGHTS c05
V. P. Bychkov, M. I. Kozar, N. N. Boyko, I. I. Borodulina, V. N. Gryaznova, V. S. Dupik, A. G. Kasatkina, Ye. V. Kolchin, M. V. Markaryan, and T. V. Fedotova *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 317-335 refs (For availability see N73-19077 10-04)
CSCL 06K

Tests were conducted on the state of health, the metabolic processes and the immunoreactivity of the organisms of six test subjects who were kept on a ration of dehydrated food products for 120 days. The data obtained in the experiment for the level of elimination of a number of substances from the organisms and for the balance of certain elements are used in calculating the food component, which is based on stores of dehydrated products, in prolonged flight with daily energy consumptions of about 3,000 kcal on the part of the cosmonauts. Adaptation of the organism to such a diet occurs in the first two months. Author

N73-19114* Techtran Corp., Glen Burnie, Md.
EVOLUTION OF THE PROBLEM OF DETECTING ORGANIC MATTER IN THE SOLAR SYSTEM c30
L. M. Pozharitskaya, B. A. Starostin, and R. B. Zezin *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 336-350 refs (For availability see N73-19077 10-04)
CSCL 03B

The origin of organic compounds which are basic for the primary forms of life is considered. The problem of detection and identification of organic matter in the solar system is directly connected with the problem of evolution of cosmic organic matter. A single plan is proposed for the evolution of organic matter which includes its biogenic and abiogenic forms. A comparison of the elemental and isotopic composition and the composition of pigments, optical activity, polymerization and cross-linking in the principal strains of evolution of organic matter in the solar system is included. Author

N73-19115* Techtran Corp., Glen Burnie, Md.
EFFECT ON INFUSORIA OF PHYSICAL CONDITIONS WHICH SIMULATE THE ENVIRONMENT ON THE SURFACE OF THE PLANET MARS c30
L. K. Lozina-Lozinskiy, V. N. Bychenkova, and E. I. Zaar *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 351-365 refs (For availability see N73-19077 10-04)
CSCL 03B

The high lability of unicellular animals and their adaptability to extremal conditions of the external environment, in particular to conditions existing on the planet Mars is shown. The infusoria Colpoda maupasi are able to multiply at low atmospheric pressure in a gas environment consisting of nitrogen, in an atmosphere of carbon dioxide at 15-16 mm Hg and less than 1% oxygen. The infusoria C. maupasi survive as dormant cysts when placed into the photostat in moistened sand at the trophont stage, in an atmosphere of carbon dioxide and during eight hours of daily ultraviolet irradiation and visible light. Daily changing temperatures above 0 C increase the division rate of the infusoria in comparison to constant temperature conditions. Author

N73-19116* Techtran Corp., Glen Burnie, Md.
PROBLEM OF THE SURVIVAL OF MICROORGANISMS UNDER CONDITIONS SIMULATING THOSE ON MARS
V. M. Rumyantseva, V. L. Levin, and M. A. Rybin *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 366-370 refs (For availability see N73-19077 10-04)
CSCL 06M

An aqueous suspension of microorganisms was placed in sand which was enriched by organic substances. Test tubes with sand were placed open into a low pressure chamber of a photostat device, where they were kept for 2-14 days in an atmosphere of carbon dioxide at a pressure of 10 mm Hg. The temperature throughout the day changed from +25 to -25 C. The most resistant of the museum cultures tested were the strains of Micrococcus luteus, but among the microorganisms separated from Antarctic soil there were two unidentified forms: C sub 1 and A sub 14. Concentration of cells in these cultures increased during the tests by 1-2 orders. Author

N73-19117* Techtran Corp., Glen Burnie, Md.
THE PHOTOSTAT-1 DEVICE FOR STUDYING THE REACTION OF ORGANISMS TO PHYSICAL CONDITIONS ON THE PLANET MARS c14
E. I. Zaar, V. G. Zelikson, M. G. Kitaygorodskiy, I. V. Koshelev, L. K. Lozina-Lozinskiy, and M. A. Rybin *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 371-377 refs (For availability see N73-19077 10-04)
CSCL 14B

A description of the photostat device which reproduces the basic parameters of the physical environment of the planet Mars is presented. Any given temperature may be maintained in its working chamber from -35 to +30 C with a maintenance accuracy of + or - 0.5 deg; it can produce a change in temperature with varying rates of cooling or heating and maintain any given pressure in a range from 5 to 95 mm Hg. The system of ultraviolet filters in the device permits irradiation with the following individual lines of the ultraviolet spectrum: 1-253.7, 280 and 356 nm, and 220-320 nm. All operational conditions of the device are maintained automatically for given programs and are recorded by automatic recording devices. Author

N73-19118* Techtran Corp., Glen Burnie, Md.
RESISTANCE OF UNICELLULAR ORGANISMS TO ULTRAVIOLET RADIATION IN RELATION TO THE PROBLEM OF THE EXISTENCE OF EXTRATERRESTRIAL LIFE c30
L. K. Lozina-Lozinskiy *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 378-392 refs (For availability see N73-19077

10-04)
CSCL 03B

The ultraviolet radiation of the sun is one of the most important factors which determine the existence of life on earth, beyond earth, in space and on planets which do not have a gas environment which absorbs shortwave ultraviolet radiation. Rays in the range 240-280 nm, which are selectively absorbed by proteins and nucleic acids, have a vigorous harmful action on terrestrial organisms. Shortwave ultraviolet radiation studies show that terrestrial organisms and cells have properties and abilities which enable them to resist shortwave ultraviolet radiation and increase their resistance to it. Examples are presented of the capability of unicellular organisms for dark reparation, the important role of pigment and protective substances which are formed in an organism, and substances present in the environment which act as shields. Author

N73-19119* Techtran Corp., Glen Burnie, Md.
THE ACTION OF ULTRAVIOLET RADIATION ON AMINO ACIDS AND PEPTIDES IN VARYING GAS ATMOSPHERES IN THE PRESENCE OF SALTS AND OXIDES OF METALS c30
M. A. Khenokh, N. P. Bogdanova, and Ye. M. Lapinskaya *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 393-406 refs (For availability see N73-19077 10-04)
CSCL 03B

Various reactions occur due to the ultraviolet effect in solutions of amino acids and peptides which have been sensitized by different cations, oxides of metals, and polyphosphoric acid. Breaking of the carbohydrate chain, hydroxylation of the aromatic ring, deamination, the formation of organic acids and carbonyl substances are reported. New amino acids are also formed. The smaller the carbohydrate chain, the less is the quantum decomposition yield of amino acids and peptides (with an identical acyl radical). It is proposed that the initially sensitized peptides in the prebiological era of our planet consisted of amino acids with a shorter chain of carbohydrate atoms. Author

N73-19120* Techtran Corp., Glen Burnie, Md.
ACTION OF A SET OF EXTREMAL FACTORS ON RIBONUCLEASE
G. S. Komolova, Ye. V. Belikova, and I. A. Yegorov *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 407-414 refs (For availability see N73-19077 10-04)
CSCL 06C

The actions of a set of certain extremal factors on solutions of ribonuclease: ultraviolet light + X-ray radiation and ultraviolet light + repeated freezing and thawing were studied. The ultraviolet and X-ray radiation caused inactivation of the ribonuclease by chemical modification of tyrosine groups in the molecule. During the combined irradiation of ribonuclease by ultraviolet and X-rays an additive summation of their actions was observed. Cryolysis caused denaturing changes in a molecule of ribonuclease which were different from those observed during photolysis. An irradiation of solutions of an enzyme increased its sensitivity to subsequent actions of freezing-thawing. Author

N73-19121* Techtran Corp., Glen Burnie, Md.
EFFECT OF A GAS ENVIRONMENT ON CATALASE CRYOLYSIS
G. S. Komolova *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 415-421 refs (For availability see N73-19077 10-04)
CSCL 06C

Catalase is inactivated during repeated freezing and thawing of its solutions. The effect depends on the temperature of freezing and the gas atmosphere. Gases tested for the degree of their effect on cryolysis in order of increasing effect on inactivation of the enzymes are: N2, He, O2, and H2. In a gas environment consisting of oxygen and nitrogen an additive summation of the effects on cryolysis which were produced by each gas separately is observed. The effect of an atmosphere consisting of hydrogen and argon and cryolysis of an enzyme revealed a significant increase of inactivation in comparison to the expected motivation for the case of additive summation of effects produced by each gas separately. Author

N73-19122*# Food and Drug Administration, Cincinnati, Ohio.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Report, 1 Jul. - 30 Sep. 1972
J. C. Wimsatt Jan. 1973 8 p
(NASA Order W-13411)
(NASA-CR-131103; QPR-30) Avail: NTIS HC $3.00 CSCL 06M

An experimental sterilization facility was developed to simulate conditions that will be encountered during terminal sterilization of space vehicles. The system consists of a temperature controlled oven with a nitrogen gas stream containing a known concentration of water. Moisture analyzers are utilized to monitor the gas flowing over spore samples contained in the oven. In its original configuration, no provision was made for the control of water vapor during the sterilization cycle. Because moisture profoundly influences the thermal inactivation of bacterial spores, an upper limit for the moisture content in the gas used to sterilize the space vehicle was established (25% RH at 0 C STP). Accordingly, a controller was developed and installed to provide these conditions in the experimental sterilization facility. Author

N73-19123*# Public Health Service, Phoenix, Ariz. Environmental Microbiology Section.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Report for Oct. - Dec. 1972
Martin S. Favero Dec. 1972 23 p
(NASA Order W-13062)
(NASA-CR-131086; Rept-40) Avail: NTIS HC $3.25 CSCL 06M

Heat studies with the highly resistant bacterial spore isolated from Cape Kennedy soil were continued, and the D130C was determined. The interior surfaces of the command module of the Apollo 17 spacecraft were studied for microbial contamination during assembly and testing. The thermal resistance of naturally occurring airborne bacterial spores was determined, using the heating times of 2, 4, 6, and 8 hr. at 125 C. The evaluation of a terminal sterilization process for unmanned lander spacecraft is also continuing. J.A.M.

N73-19124*# Techtran Corp., Silver Spring, Md.
CIRCULATION AND WATER BALANCE DURING IMMERSION IN A WATER BATH
D. Kaiser, P. Eckert, O. H. Gauer, and H.-J. Linkenbach Washington NASA Mar. 1973 4 p refs Transl. into ENGLISH from Arch. Ges. Physiol. (Berlin), v. 278, no. 52, 1963 p 52-53
(Contract NASw-2485)
(NASA-TT-F-14834) Avail: NTIS HC $3.00 CSCL 06S

Immersion of the human body in a temperature-controlled bath leads to a three-fold increase in water diuresis, mainly at the expense of the blood plasma. Author

N73-19125# Civil Aeromedical Inst., Oklahoma City, Okla.
AUDITORY EFFECTS OF NOISE ON AIR CREW PERSONNEL
Jerry V. Tobias Nov. 1972 9 p refs
(FAA-AM-72-32) Avail: NTIS HC $3.00

Hearing-threshold tests were made on flight personnel of several sorts, including aerial-application pilots, flight instructors, private pilots, stewardesses, and FAA flight inspectors. Excluding those people whose flight experience is of short duration, each group shows some measurable degree of threshold shift, although this shift is frequently not enough to be regarded as a clinically significant entity. Data on the sorts of noise exposures each group commonly receives are presented, and some cautions are offered regarding interpretation of the data. Author

N73-19126*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF SPACE BIOLOGY. VOLUME 15: FUNCTIONAL MORPHOLOGY DURING EXTREMAL ACTIONS
Ye. F. Kotovskiy, L. L. Shimkevich, and P. V. Vasilyev, ed Washington NASA Feb. 1973 488 p refs Transl. into ENGLISH of the book "Problemy Kosmicheskoy Biologii. Tom 15: Funktsionalnaya Morfologiya pri Ekstremalnykh Vozdeystviyakh" Moscow, Nauka, 1971 385 p
(Contract NASw-2037)
(NASA-TT-F-738) Avail: NTIS HC $6.00 CSCL 06C

Data is presented on the functional morphology of various organs and tissues during action cn the organism of several

factors of space flight: g-forces, hypoxia and hyperoxia. A detailed account is given of the state of the basic functional systems of the organism: the central nervous system, the respiratory system, the cardiovascular system, the digestive system, the excretory system and the endocrine system. Correlations are made between the physiological and histological indices. Particular attention is given processes occurring at the cellular level. On the basis of data in the literature, and observations on flight and electron microscopy, histochemistry, and biochemistry, changes in the fine structure and metabolism in cells, tissues, and organs are analyzed. The action mechanisms of external factors on the cell are analyzed in detail. Author

N73-19127*# Naval Biomedical Research Lab., Oakland, Calif.
STUDIES ON POSSIBLE PROPAGATION OF MICROBIAL CONTAMINATION IN PLANETARY CLOUDS Annual Report
R. L. Dimmick and M. A. Chatigny 15 Jan. 1973 42 p refs
(NASA Order W-13450)
Avail: NTIS HC $4.25 CSCL 06M

Current U.S. planetary quarantine standards based on international agreements require consideration of the probability of contamination (Pc) of the outer planets, Venus, Jupiter, Saturn, etc. One of the key parameters in estimation of the Pc of these planets is the probability of growth (Pg) of terrestrial microorganisms on or near these planets. For example, Jupiter and Saturn appear to have an atmosphere in which some microbial species could metabolize and propagate. This study includes investigation of the likelihood of metabolism and propagation of microbes suspended in dynamic atmospheres. It is directed toward providing experimental information needed to aid in rational estimation of Pg for these outer plants. Author

N73-19128# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
A PROGRAM FOR AUTOMATIC ANALYSIS OF BIOLOGICAL PARAMETERS
L. Pastena and A. Verdecchia 21 Apr. 1972 34 p refs In ITALIAN; ENGLISH summary
(ISS-72/4) Avail: NTIS HC $3.75

A computer program is described for the evaluation of the stimulated modifications of n biological parameters (n equal to or less than 5). The program forecasts statistical tests on the validity of the variations that parameter suffer in the time and furthermore offers the possibility to comparatively evaluate different variations of the same. Author

N73-19129*# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. Dept. of Physiology.
SPECIALIZED PHYSIOLOGICAL STUDIES IN SUPPORT OF MANNED SPACE FLIGHT
U. C. Luft Feb. 1973 164 p refs
(Contract NAS9-12572)
(NASA-CR-128741) Avail: NTIS HC $10.25 CSCL 06S

The areas of physiological research reported include: (1) evaluation of the single-breath method for determining cardiac output, (2) optimum protocol for the assessment of cardiopulmonary competence, (3) body fluids and electrolytes under conditions of single and combined stress, (4) re-evaluation of the open-circuit method for measuring metabolic rate with regard to the alleged metabolic production of gaseous nitrogen, and (5) the use of the forced-oscillation method to determine total respiratory conductance in healthy subjects and pulmonary patients. F.O.S.

N73-19130*# Battelle-Northwest, Richland, Wash. Physics and Instrumentation Dept.
KINETIC ASPECTS OF BONE MINERAL METABOLISM Final Report, 4 Jan. 1972 - 3 Jan. 1973
H. E. Palmer 2 Jan. 1973 34 p refs
(Contract NAS9-12463)
(NASA-CR-128816) Avail: NTIS HC $3.75 CSCL 06C

Two techniques were studied for measuring changes in bone mass in rats. One technique measures the Ar-37 produced from calcium during neutron irradiation and the other measures the changes in the Na-22 content which has been incorporated within the rat bone. Both methods are performed in vivo and cause no significant physiological damage. The Ar-37 leaves the body of a rat within an hour after being produced, and it can be quantitatively collected and measured with a precision of - or + 2% on the same rat. With appropriate irradiation conditions it appears that the absolute quantity of calcuim in any rat can be determined within - or + 3% regardless of animal size. The Na-22 when uniformly distributed in bone, can be used to monitor bone mineral turnover and this has been demonstrated in conditions of calcium deficiency during growth and also pregnancy coupled with calcium deficiency. Author

N73-19131*# Louisiana State Univ., New Orleans. Dept. of Biological Sciences.
ANALYSIS OF CHEMICAL COMPONENTS FROM PLANT TISSUE SAMPLES Final Progress Report
John L. Laseter Dec. 1972 85 p refs
(Contract NAS9-11339)
(NASA-CR-128740) Avail: NTIS HC $6.25 CSCL 06C

Information is given on the type and concentration of sterols, free fatty acids, and total fatty acids in plant tissue samples. All samples were analyzed by gas chromatography and then by gas chromatography-mass spectrometry combination. In each case the mass spectral data was accumulated as a computer printout and plot. Typical gas chromatograms are included as well as tables describing test results. Author

N73-19132*# General Electric Co., Philadelphia, Pa. Space Div.
IMBLMS PHASE B4, ADDITIONAL TASKS 5.0. MICROBIAL IDENTIFICATION SYSTEM
29 Oct. 1971 93 p refs Original contains color illustrations
(Contract NAS9-10741)
(NASA-CR-128747; Doc-70SD5414) Avail: NTIS HC $6.75 CSCL 06M

A laboratory study was undertaken to provide simplified procedures leading to the presumptive identification (I/D) of defined microorganisms on-board an orbiting spacecraft. Identifications were to be initiated by nonprofessional bacteriologists, (crew members) on a contingency basis only. Key objectives/constraints for this investigation were as follows:(1) I/D procedures based on limited, defined diagnostic tests, (2) testing oriented about ten selected microorganisms, (3) provide for definitive I/D key and procedures per selected organism, (4) define possible occurrences of false positives for the resulting I/D key by search of the appropriate literature, and (5) evaluation of the I/D key and procedure through a limited field trial on randomly selected subjects using the I/D key. Author

N73-19133*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
RADIATION PROTECTION HANDBOOK
29 Nov. 1972 62 p
(NASA-TM-X-69410; KHB-1860.1/IS) Avail: NTIS HC $5.25 CSCL 18F

A handbook which sets forth the Kennedy Space Center radiation protection policy is presented. The book also covers administrative direction and guidance on organizational and procedural requirements of the program. Only ionizing radiation is covered. Author

N73-19134# California Univ., Berkeley. Lawrence Berkeley Lab.
BIOLOGICAL EFFECTS DUE TO SINGLE ACCELERATED HEAVY PARTICLES AND THE PROBLEMS OF NERVOUS SYSTEM EXPOSURE IN SPACE
C. A. Tobias, T. F. Budinger, and J. T. Lyman Jul. 1972 30 p refs Presented at COSPAR Conf., Madrid, 10 May 1972
(Contract W-7405-eng-48)
(LBL-1011; Conf-720556-1) Avail: NTIS

A review is presented of studies on light flashes and similar visual phenomena experienced by astronauts during space flight. Studies on light sensations from heavily ionizing particles included exposure to fast neutrons in the 300 to 600 MeV energy range, fission neutrons from Cf-252, helium ions, and nitrogen ions. Studies on light sensation from relativistic particles included production of light flash events by energy transfer in the ionization track, by light from Cherenkov irradiation, and by fluorescence induced in some part of the eye. Discussions are also presented of light sensations from X-rays and the nature of the critical physical interactions. NSA

N73-19135# Oak Ridge National Lab., Tenn. Toxicology Information Research Center.
BIOLOGICAL EFFECTS OF TITANIUM
Martha Gerrard Oct. 1972 11 p refs Sponsored by AEC
(ORNL-TIP/TIRC-72-65) Avail: NTIS

The bibliography is prepared in response to a specific query received by the Toxicology Information Response Center. It covers the various aspects of titanium health hazards in industrial workers and toxic effects of titanium traces in human and animal organisms. G.G.

N73-19136# Oak Ridge National Lab., Tenn. Toxicology Information Response Center.
TOXICITY AND BIOLOGICAL EFFECTS OF ALUMINUM IN ANIMALS
Martha Gerrard Nov. 1972 18 p
(Contract W-7405-eng-26)
(ORNL-TIP/TIRC-72-76; NLM-IA-40-274-71) Avail: NTIS

A literature search was made on toxicity and biological effects of aluminum and various other chemical compounds in animals, particularly humans. Data cover authors cited and damage noted in tissues, body, or animal observed. E.H.W.

N73-19137# Freiburg Univ. (West Germany). Lab. fuer Chemie.
REACTIVATION OF PHOSPHORYLATED ACETYLCHOLINESTERASE WITH QUATERNARY PYRIDINE OXIMES: DETERMINATION OF INFLUENCING FACTORS [REAKTIVIERUNG PHOSPHORYLIERTER ACETYLCHOLIN-ESTERASE MIT QUATERNIERTEN PYRIDIN-OXIMEN: ERMITTLUNG MASSGEBENDER FAKTOREN]
Ilse Hagedorn Bonn Bundeswehramt 1972 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-32) Avail: NTIS HC $4.00; Bundeswehramt, Bonn: 25 DM

The systematic examination of factors influencing the reactivation of phosphorylated acetylcholin-esterase has shown that only oximes with K sub a values between 7.6 and 7.9 are effective (optimum at pK sub a approximately 7.8). Oximes with a pK sub a value less than 7.6 are useless as AChE-reactivators, because their anions are not sufficiently nucleophile, whereas aldoximes with a pK sub a greater than 7.9 are inactive, because their methin-protons are not sufficiently acid. Steric phenomena do not have a decisive influence. The second step of the reactivation is, under physiological conditions in the case of oximes with a pK sub a less than 7.9, an alpha, beta-cis-elimination of phosphoric acid from phosphorylated oximes and takes place as a cyclic mechanism. Author (ESRO)

N73-19138# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.
INHIBITING AND ACTIVATING EFFECT OF MONO- AND BI-QUATERNARY PYRIDINE OXIME REACTIVATORS AND RELATED COMPOUNDS ON STRUCTURE-BOUND ACETYLCHOLINE ESTERASE IN VITRO [INHIBIERENDE UND AKTIVIERENDE WIRKUNG VON MONO- UND BIS-QUARTAEREN PYRIDINIUMOXIMREAKTIVATOREN UND VERWANDTEN VERBINDUNGEN AUF STRUKTURGEBUNDENE ACETYLCHOLINESTERASE IN VITRO]
H. Kuhnen Bonn Bundeswehramt 1972 44 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-9) Avail: NTIS HC $4.25; Bundeswehramt, Bonn: 25 DM

The effects of mono- and bi-quaternary pyridoxine reactivators on membranes of bovine red cells was investigated. Acetylcholine chloride was chosen as a substrate. The derivatives act both as inhibitors and as activators on the enzyme. The effects depend not only on the concentration of the reactivator, but also on that of the substrate. The mechanism of action of the enzyme and the antagonist is a mixed competitive-noncompetitive one. The activation of the enzyme is due to the attachment of the antagonist to a secondary binding site. This induces an activating effect on the active site of the AChE. These suggestions are supported by the results obtained with acetyl-beta-methylcholine as substrate and by the reactivation of AChE inactivated by carbamoylcholine. Author (ESRO)

N73-19139# Defence Research Information Centre, Orpington (England).
APPLICATION OF THE OXYGEN METHOD IN ALGOTOXIC INVESTIGATIONS
L. P. Braginskii Nov. 1972 14 p refs Transl. into ENGLISH from Radioactiva Isotopy V.C-Idrosbiol. i Metody Sanit. Gidrobiol. Acad. Nauk SSR Zool. Inst., 1964 p 108-116
(DRIC-Trans-2991; BR-30357) Avail: NTIS HC $3.00

Research was carried out in the field of algotoxiocology for removing biological nuisances from water supplies. In so far as photosynthesis is a vital process to a growing organism, its retardation or advancement, determined by the amount of oxygen produced by the algae, may give an indication of the toxicity of various substances. Using the oxygen method, test substances (herbicides, chlorine compounds, chloracetic acid derivatives) were introduced to vessels containing different types of algae and the rate of photosynthesis studied. It was found that some species of algae flourished in conditions of contamination while others died. The results are discussed. ESRO

N73-19140# Naval Submarine Medical Research Lab., Groton, Conn.
IMPROVING ABSOLUTE DISTANCE ESTIMATION IN CLEAR AND IN TURBID WATER Medical Research Progress Report No. 9
Steven H. Ferris 25 May 1972 13 p refs
(AD-752976; NSMRL-710) Avail: NTIS CSCL 06/19

Since the errors made in estimating distance under water are dependent on the degree of water turbidity, improvement through training in one body of water will not transfer to another body of water if there is a large difference in turbidity. This experiment demonstrated that the transfer problem can be overcome by training divers under different turbidity conditions so that they learn to tailor their corrections to the prevailing conditions. This training procedure would be useful for all diving tasks in which the estimations of object distances is important. Author

N73-19141# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
ACCURACY OF THE MEAN THRESHOLD AND OF THE VARIABILITY IN THE PSYCHOPHYSICAL METHOD OF CONSTANT STIMULI
Robert M. Herrick 19 Oct. 1972 42 p refs
(MF51524004)
(AD-753009; NADC-72204-CS) Avail: NTIS CSCL 05/10

The methodology used to study the sensory capabilities of man in relation to display systems is psychophysics. One of the most common psychophysical methods in use is the Method of Constant Stimuli (MCS). Although the method has been in use for more than half a century, reliable estimates of the accuracy of the method are not available. To assess the accuracy of the MCS-specifically, the accuracy of the mean and standard deviation-simulations of MCS experiments were performed. In the simulations, the number of stimuli varied from 2 to 13, the number of judgments per stimulus varied from 10 to 320, the range of stimuli varied from a case where the probability (p) of a Yes response for the extreme stimuli were p = .05 and p = 95. to a case where the extreme stimuli had associated p values of .40 and .60. Curves and equations derived from the simulation data give accurate estimates of the standard error of the mean threshold and of the 90% confidence limits of the standard deviation. Author (GRA)

N73-19142# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECTS OF SODIUM PENTOBARBITAL ON RATS IN NORMOCAPNIC AND CHRONICALLY HYPERCAPNIC CONDITIONS
Robert G. Streeter and Robert L. Rogers Sep. 1972 13 p refs
(AF Proj. 7164)
(AD-751234; SAM-TR-72-29) Avail: NTIS CSCL 06/15

Albino rats were exposed to a 160 torr O2, 68 torr CO2 gaseous environment at a total pressure of 380 torr and tested for the response to sodium pentobarbital anesthesia. Measurements of the time to ataxia, supine recombency, and surgical plane (lack of pedal reflex), and total sleep times were made. There was no significant difference in times to ataxia, supine

recumbency, and surgical plane between the hypercapnic rats and controls although the mean time was greater for the hypercapnic rats in each measurement. Hypercapnic rats had increased total sleep times as compared to control animals.
Author (GRA)

N73-19976* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
LIPID-ABSORBING POLYMERS
H. E. Marsh, Jr. and C. J. Wallace *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 1-6 refs (For availability see N73-19975 10-34)
CSCL 06E

N73-19977* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Applied Mechanics Div.
UNIFIED APPROACH TO THE BIOMECHANICS OF DENTAL IMPLANTOLOGY
D. E. Grenoble (Univ. of Southern Calif., Los Angeles) and A. C. Knoell *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 7-17 refs (For availability see N73-19975 10-34)
CSCL 06E

N73-19531 Joint Publications Research Service, Arlington, Va.
HEALTH EVALUATION OF ELECTRON BEAM WELDING OF BERYLLIUM BRONZE
D. M. Bobrishchev-Pushkin, L. A. Naumova, and N. A. Khelkovskiy-Sergeyev *In its* Selected Transl. in Met. 5 Feb. 1973 p 10-13 refs (For availability see N73-19528 10-17)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-19143# Advisory Group for Aerospace Research and Development, Paris (France).
PERFORMANCE AND BIODYNAMIC STRESS - INFLUENCE OF INTERACTING STRESSES ON PERFORMANCE
Nov. 1972 110 p refs Proc. of AGARD Aerospace Med. Panel Specialist Meeting, Brussels, 2 Jun. 1972
(AGARD-CP-101) Avail: NTIS HC $7.50

The interactions of operational flight stresses and their effects on human performance are considered at this conference. For individual titles, see N73-19144 through N73-19156.

N73-19144 Royal Aircraft Establishment, Farnborough (England). Environmental Effects Section.
EARLY THOUGHTS ON COMPOUND STRAINS
Geoff Allen *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 8 p refs (For availability see N73-19143 10-05)

Jargon on the subject is briefly discussed, and it is reasoned that the term compound strains may frequently be more appropriate than combined stresses. Two compound strain problems of immediate and widespread importance, on which there is an urgent need to increase the present scanty information, are cited. The first is the effects of other mental and physical stresses on the signal to noise ratios required for communication; the second, the biodynamics of vibratory motion sickness, particularly the interaction with other loads such as vision, heat and odors.
Author

N73-19145 Royal Aircraft Establishment, Farnborough (England). Human Engineering Div.
A FLIGHT TEST PROGRAMME TO STUDY THE EFFECTS OF ENVIRONMENTAL STRESSES ON AIRCREW OPERATING MILITARY STRIKE AIRCRAFT
M. G. Trumper *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 5 p refs (For availability see N73-19143 10-05)

A flight test program is designed to obtain objective measurements of noise, vibration and temperature throughout typical profiles flown by military strike aircraft, and, as far as is possible, to correlate the measurements with aircrew reaction and performance. As a secondary object the program will investigate the usefulness of a water-cooled suit installation as a means of relieving aircrew thermal stress in strike aircraft.
Author

N73-19146 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TWO EXPERIMENTS ON THE EFFECTS OF COMBINED HEAT, NOISE AND VIBRATION STRESS
Walter F. Grether *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 8 p refs (For availability see N73-19143 10-05)
(AMRL-TR-71-113)

Operational flying often exposes crew members to combinations of environmental stresses. To obtain a better understanding of such combined-stress effects a major experiment was conducted using heat, noise, and vibration, both singly and in combination. Measurements were made of tracking ability, choice reaction time, voice communication, mental arithmetic, visual acuity, body temperature, heart rate, weight loss, and subjective ratings of the stress. On none of these measures did the combined triple stress condition produce greater effects than did the most severe single stress. On the physiological measures only heat stress produced significant effects, and the addition of noise and vibration produced no further effects. On the performance measures, particularly the tracking test, impairment was slightly less for the triple stress condition than for vibration only. Thus there were no additive interactions, and in fact some evidence of antagonistic interactions.
Author

N73-19147 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
COMBINED EFFECTS OF NOISE AND VIBRATION ON COGNITIVE AND PSYCHOMOTOR PERFORMANCE
Henry C. Sommer and C. Stanley Harris *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 10 p refs (For availability see N73-19143 10-05)
(AMRL-TR-71-115)

Five studies on the combined effects of noise and vibration on psychomotor and cognitive performance are reported. Tracking and reaction time tasks were used as measures of psychomotor performance and a short-term memory/subtraction task was used as a measure of cognitive performance. The first study, using tracking performance, suggested an additive effect of noise and vibration on performance, however, this was not confirmed in a second study. Two additional studies conducted with the cognitive task indicated that detrimental effects on this task occurred only when noise and vibration were combined. Further, the effect seemed to be related to frequency of vibration; only 5 Hz - 0.25 gz vibration combined with noise produced an adverse effect on the task. The final investigation was concerned with the effect combined noise and vibration stress had on cognitive performance as a function of time of day. The results indicate that time of day does not appear to be a particularly strong variable.
Author

N73-19148 Institute of Aviation Medicine, Fliegehorst (West Germany).
SOME CRITICAL COMMENTS ON THE MEASUREMENT OF IN-FLIGHT STRAINS
W. Hoffelt and K. Gerbert *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 4 p refs (For availability see N73-19143 10-05)

Ways and means for aviation physicians and aviation psychologists to clarify the question of the overall stress imposed on flying personnel are discussed. Methodical difficulties are presented which result especially in the measurement of psychophysiological reactions to flying stress. Research psychological questionnaires and evaluation techniques are the only means which offer partial assessment possibilities concerning the problem of flying stress.
Author

N73-19149 Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
EMOTIONAL AND CARDIOVASCULAR STRESSES OF CENTRIFUGATION: EFFECT OF BETA RECEPTOR

BLOCKADE ON HEART RATE RESPONSE

D. H. Glaister, M. F. Allnutt, M. H. Harrison, and P. Fennessy *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 13 p refs (For availability see N73-19143 10-05)

Twenty four subjects were used in a double blind trial to investigate the effect of beta adrenergic blockade on the heart rate response to acceleration. Oxprenolol, 0.2 mg/kg body weight, or saline placebo, was injected in paired trials, and subjects then performed a tracking task and submitted to three centrifuge runs. Heart rate and blood pressure were monitored continuously. Oxprenolol reduced resting heart rate, and abolished a steady increase in base line heart rate seen in placebo experiments, and attributed to activation of the adrenal medulla. Tachycardia in response to +2G sub z acceleration was prevented by beta blockade, except in a group of six subjects experiencing their first ever centrifuge ride. Heart rates at +3G sub z were lowered by oxprenolol, the persistent tachycardia being attributed to a baroreceptor reflex mediated through a reduction in vagal tone. Pulse pressure was reduced by oxprenolol, especially during +3G sub z acceleration, an effect attributed to a reduction in cardiac output secondary to a fall in heart rate. Greyout tolerance was unaffected by beta blockade, but a small and unexplained decrement in tracking performance was observed. Author

N73-19150 School of Aerospace Medicine, Brooks AFB, Tex.

ESTIMATES OF PHYSIOLOGIC RESERVE AFTER ACCELERATION EXPOSURE IN MAN

Frank R. Lecoco, Richard L. Lipman, and Sidney D. Leverett, Jr. *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 6 p refs (For availability see N73-19143 10-05)

A metabolic stressor was employed to provoke gluco-regulatory hormone response immediately after exposure of subjects to acceleration stress. 2-deoxy-D-glucose, a glucose analog which produces severe intracellular hypoglycemia, was infused in eight normal male volunteers during a control period, immediately after an initial experience with acceleration and after their fourth exposure to acceleration. Blood glucose, free fatty acids, insulin, growth hormone and cortisol and urinary epinephrine and norepinephrine were measured before and after each infusion of 2-deoxy-D-glucose. Although acceleration stress was modest, readily discernible changes in gluco-regulatory response to the metabolic stressor were detected after exposure to acceleration. Author

N73-19151 School of Aerospace Medicine, Brooks AFB, Tex.

FINDINGS ON THE COST OF FLYING TRANSPORT MISSIONS

Bryce O. Hartman and Henry B. Hale *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 7 p refs (For availability see N73-19143 10-05)

Physiologic and psychologic data from airlift missions flying in an operational configuration included inflight measurements during experimental double-crew missions and basic crew missions with staging for crew rest, as well as following approximately 125 basic missions using a special workload log. Psychologic analyses have evaluated subjective fatigue, sleep, and crew workload, and the relationship between these and endocrine-metabolic activity assayed via urine. The cost of flying a transport mission in the face of multiple stresses characteristic of the operational environment is considered. Author

N73-19152 Centre d'Essais en Vol, Bretigny-sur-Orge (France).

PHYSIOLOGICAL MODIFICATIONS DURING OPERATIONAL FLIGHTS OF LONG DURATION [MODIFICATIONS PHYSIOLOGIQUES AU COURS DE VOLS OPERATIONNELS DE LONGUE DUREE]

R. Auffret *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 12 p refs In FRENCH (For availability see N73-19143 10-05)

Physiological changes occurring in pilots and navigators during long duration flights are examined as a function of energy fatigue. Data cover cardiac frequency, elimination of hydroxcorticosteroides in urine, elimination of mucoprotein, and glycemia levels over a 24 hour period. Transl. by E.H.W.

N73-19153 Naval Aerospace Medical Research Lab., Pensacola, Fla. Human Factors Engineering Research Div.

EFFECTS OF PART-WHOLE TRAINING PROCEDURES UPON THE ACQUISITION OF COMPLEX SKILLS TO BE PERFORMED UNDER STRESS

Richard S. Gibson *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 4 p refs (For availability see N73-19143 10-05)

Aviation training generally follows a sequential part task approach. The question of how many tasks should be presented at one time is considered. Seventy-two naval officer candidates participated in the experiment. Each subject experienced one of three training conditions prior to being exposed to the final test condition. The results provide insight into the use of part-whole training procedures for the acquisition of complex perceptual psychomotor skills. Author

N73-19154 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

PERFORMANCE MEASUREMENT USING PILOT CONTROLLED Gz MANEUVERING WITH SIMULATED OPERATIONAL TASK

D. B. Rogers, F. M. Holden, C. R. Replogle, G. Potor, C. N. Day, R. E. VanPatten, K. A. Smiles, and G. C. Mohr *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 5 p refs (For availability see N73-19143 10-05)
(AMRL-TR-72-3)

A technique for human performance measurement using a closed loop centrifuge has been validated. The simulation utilized the pitch and roll dynamics of a high performance aircraft. The measurement criteria were hits on target using a display generated heads up gunsight on a maneuvering target aircraft. An important consideration was relationship between man as a passive rider versus man as an active participant in the generation of the Gz stress. Two important demonstrations resulting from this study are: (1) there is a significant difference in the ability of subject pilots to perform in closed versus open loop configuration; and (2) it is feasible to provide a mission related human performance metric in a selective simulation in which the +Gz forces are dynamically realistic. A predictive heads up gunsight display is utilized with target trajectories representative of aerial combat maneuvers. Author

N73-19155 Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

PHYSIOLOGICAL STUDIES OF FATIGUE IN ACTIVITIES REQUIRING MENTAL CONCENTRATION IN HOT CLIMATE, THE INFLUENCE OF POSITIONING AND SENSORIAL IRRITATION

J. Meyer-Delius *In* AGARD Performance and Biodyn. Stress - Influence of Interacting Stresses on Performance Nov. 1972 8 p refs (For availability see N73-19143 10-05)

Activities of vigilance without additional influence of psychical stress or energetic upset are demonstrated in hot and temperate climate with noradrenergetic reaction. Mental effort with slightly increased energetic metabolism required 20% more time in hot climate to complete tasks than was required by persons working under temperate conditions. In this case the pulse rate was rising continuously. Under identical conditions of climate and mental work, but with noise, the pulse rate was significantly higher than without sensory irritation. Excitation of the sensorial senses leads to an additional increase in the peripheral vascular constriction. Opposed to thermoregulation it can cause disregulation and thus fatigue. Author

N73-19156 School of Aerospace Medicine, Brooks AFB, Tex. Biodynamics Branch.

THE USE OF PHYSIOLOGICAL PROTECTIVE MANEUVERS IN HIGH ACCELERATION ENVIRONMENTS

S. J. Shubrooks, Jr. and S. D. Leverett, Jr. *In* AGARD Performance and Biodyn. Stress Influence of Interacting Stresses on Performance Nov. 1972 9 p refs (For availability see N73-19143 10-05)

The physiological effects of voluntary maneuvers used for protection against +G sub z acceleration were studied on the human centrifuge. During both 15-sec. and 45-sec. rapid onset +G sub z exposures, the increases in tolerance achieved with

the Valsalva straining maneuver (forcefully exhaling against the completely closed glottis) were found to be equivalent to those achieved with the M-1 maneuver (forcefully exhaling against the partially closed glottis), either combined with use of an anti-G suit or without the suit during generalized muscular tensing. Directly measured head level arterial pressure responses correlated with these findings. The use of positive pressure breathing, at levels of 25-40 mm Hg, was also found to result in increases in tolerance, both with and without use of the anti-G suit, at least equal to those obtained with the M-1 maneuver with less accompanying discomfort and fatigue. Author

N73-19157*# Houston Univ., Tex. Dept. of Civil Engineering.
FACTORS CONCERNED WITH SANITARY LANDFILL SITE SELECTION: GENERAL DISCUSSION
W. J. Graff and L. J. Stone 31 Aug. 1972 48 p refs
(Contract NAS9-12646)
(NASA-CR-128744) Avail: NTIS HC $4.50 CSCL 06I

A general view of factors affecting site selection for sanitary landfill sites is presented. Examinations were made of operational methods, possible environment pollution, types of waste to be disposed, base and cover materials, and the economics involved in the operation. E.H.W.

N73-19158*# Grumman Aerospace Corp., Bethpage, N.Y.
STUDY OF WATER RECOVERY AND SOLID WASTE PROCESSING FOR AEROSPACE AND DOMESTIC APPLICATIONS. VOLUME 1: FINAL REPORT SUMMARY
Charles A. Guarneri, Arnold Reed, and Ronald E. Renman Dec. 1972 32 p 2 Vol.
(Contract NAS9-12503)
(NASA-CR-128857; DWR-630-09-Vol-1) Avail: NTIS HC $3.75 CSCL 06I

This study of water reclamation and waste disposal is directed toward a more efficient utilization of natural resources. From an ecological standpoint improved methods of land use, water processing equipment, and ideal population profiles are investigated. Methods are described whereby significant reduction in water usage can be achieved by the adoption of presently available and practically applied technological concepts. Allowances are made for social, natural, and economic contingencies which are likely to occur up to the year 2000. J.M.M.

N73-19159*# Grumman Aerospace Corp., Bethpage, N.Y.
STUDY OF WATER RECOVERY AND SOLID WASTE PROCESSING FOR AEROSPACE AND DOMESTIC APPLICATIONS. VOLUME 2: FINAL REPORT
Charles A. Guarneri, Arnold Reed, and Ronald E. Renman Dec. 1972 212 p refs 2 Vol.
(Contract NAS9-12503)
(NASA-CR-128858; DWR-630-09-Vol-2) Avail: NTIS HC $12.75 CSCL 06I

The manner in which current and advanced technology can be applied to develop practical solutions to existing and emerging water supply and waste disposal problems is evaluated. An overview of water resource factors as they affect new community planning, and requirements imposed on residential waste treatment systems are presented. The results of equipment surveys contain information describing: commercially available devices and appliances designed to conserve water; devices and techniques for monitoring water quality and controlling back contamination; and advanced water and waste processing equipment. System concepts are developed and compared on the basis of current and projected costs. Economic evaluations are based on community populations of from 2,000 to 250,000. The most promising system concept is defined in sufficient depth to initiate detailed design. Author

N73-19160*# Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
FURTHER DEVELOPMENT AND TESTING OF THE METABOLIC GAS ANALYZER Final Report
31 Jan. 1973 13 p
(Contract NAS9-12759)
(NASA-CR-128842; FR-1107-101) Avail: NTIS HC $3.00 CSCL 06B

Continued development of a metabolic monitor utilizing a mass spectrometer and digital computer to perform measurements and data reduction, is reported. The device prints-out breath-by-breath values for 02 consumption, C02 production, minute volume and tidal volume. The flow is measured by introduction of a tracer gas to the expired gas stream. Design modifications to reduce pressure drop in the flow splitter to one inch of water at 600 liters/min flow and to extend the range of linear flow measurement to 1000 liters/min are discussed. G.G.

N73-19161*# Martin Marietta Corp., Denver, Colo.
WATER RECOVERY AND SOLID WASTE PROCESSING FOR AEROSPACE AND DOMESTIC APPLICATIONS Final Report
Carlos Murawczyk Jan. 1973 42 p
(Contract NAS9-12504)
(NASA-CR-128839; MCR-73-7; MCR-72-277) Avail: NTIS HC $4.25 CSCL 06I

The work is described accomplished in compiling information needed to establish the current water supply and waste water processing requirements for dwellings, and for developing a preliminary design for a waste water to potable water management system. Data generated was used in formulation of design criteria for the preliminary design of the waste water to potable water recycling system. The system as defined was sized for a group of 500 dwelling units. Study tasks summarized include: water consumption, nature of domestic water, consumer appliances for low water consumption, water quality monitoring, baseline concept, and current and projected costs. Author

N73-19162*# Loewy (Raymond)/Snaith (William), Inc., New York.
HABITABILITY STUDY SHUTTLE ORBITER Summary Report, Jan. - Dec. 1972
Dec. 1972 32 p
(Contract NAS9-12479)
(NASA-CR-128863) Avail: NTIS HC $3.75 CSCL 05E

Studies of the habitability of the space shuttle orbiter are briefly summarized. Selected illustrations and descriptions are presented for: crew compartment, hygiene facilities, food system and galley, and storage systems. F.O.S.

N73-19163*# Loewy (Raymond)/Snaith (William), Inc., New York.
HABITABILITY STUDY SHUTTLE ORBITER Final Report, 24 Jan. 1972 - 27 Jan. 1973
27 Jan. 1973 144 p
(Contract NAS9-12479)
(NASA-CR-128864) Avail: NTIS HC $9.25 CSCL 05E

Habitability design concepts for the Shuttle Orbiter Program are provided for MSC. A variety of creative solutions for the stated tasks are presented. Sketches, mock-ups, mechanicals and models are included for establishing a foundation for future development. Author

N73-19164*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power Dept.
STUDY TO VALIDATE THE NON-INTERFERENCE PERFORMANCE ASSESSMENT (NIPA) TECHNIQUE Final Report
J. S. Seeman and G. L. Murphy Feb. 1973 73 p refs
(Contract NAS9-13048)
(NASA-CR-128865; MDC-G4465) Avail: NTIS HC $5.75 CSCL 06K

The NIPA (Non-Interference Performance Assessment) technique involves direct observation of group verbal activities by trained observers who rate the emotional content (affect) of each verbal interaction as either positive, negative, or neutral. During the test, in which four men were confined for 90 consecutive days, feasibility of the NIPA technique was demonstrated and observer reliability was verified. However, the validity of the test was not proved because an independent criterion measure of morale for the confined crew was lacking. There were indications, however, that NIPA measures were tracking changes in crew morale. At approximately the two-thirds point (Days 60 to 70), morale apparently fell dramatically for a period of about ten days, and simultaneously NIPA measure of positive verbalization decreased in number. A need was indicated for a separate study to apply the NIPA technique under experimental conditions and using a clearly defined criterion

measure against which the ability of NIPA observations to truly measure morale changes could be determined. Author

N73-19961 British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
MODELING OF RANDOM HUMAN VISUAL SEARCH PERFORMANCE BASED ON THE PHYSICAL PROPERTIES OF THE EYE
Ian Overington *In* AGARD Air to Ground Target Acquisition Nov. 1972 12 p refs (For availability see N73-19959 10-34)

N73-19965 Nottingham Univ. (England). Dept. of Psychology.
PERIPHERAL ACUITY WITH COMPLEX STIMULI AT TWO VIEWING DISTANCES
J. R. Bloomfield *In* AGARD Air to Ground Target Acquisition Nov. 1972 10 p refs (For availability see N73-19959 10-34)

N73-19967 Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
AIR-TO-GROUND VISIBILITY OF LIGHTS AT LOW BACKGROUND LEVELS
John H. Taylor *In* AGARD Air to Ground Target Acquisition Nov. 1972 8 p refs (For availability see N73-19959 10-34)

N73-19972 University of Technology, Leicester (England). Dept. of Ergonomics and Cybernetics.
THE EFFECTS OF BRIEFING ON TELEVISUAL TARGET ACQUISITION
K. R. Parkes *In* AGARD Air to Ground Target Acquisition Nov. 1972 9 p refs (For availability see N73-19959 10-34)

N73-19974 British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
SOME PSYCHOMETRICS IN RELATION TO TARGET ACQUISITION
Sandra J. Seale *In* AGARD Air to Ground Target Acquisition Nov. 1972 7 p refs (For availability see N73-19959 10-34)

N73-19985* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Data Systems Div.
THE MESA ARIZONA PUPIL TRACKING SYSTEM
D. L. Wright *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 87-92 (For availability see N73-19975 10-34)
CSCL 05E

N73-19099* Techtran Corp., Glen Burnie, Md.
PRESERVATION OF URINE IN A SYSTEM FOR REGENERATION OF WATER FROM IT
L. N. Rogatina, A. M. Karagodina, and V. A. Panchenko *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 210-215 (For availability see N73-19077 10-04)
CSCL 06K

N73-19104* Techtran Corp., Glen Burnie, Md.
PECULIARITIES OF DETERMINING THE OXIDIZABILITY OF WATER DURING ITS REGENERATION
V. A. Kryuchkov and N. S. Mareyeva *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 244-253 refs (For availability see N73-19077 10-04)
CSCL 06K

N73-19105* Techtran Corp., Glen Burnie, Md.
STUDY OF THE TECHNOLOGY OF DECONTAMINATION OF WATER WHICH HAS BEEN REGENERATED FROM THE LIQUID PRODUCTS OF HUMAN VITAL FUNCTIONS
V. A. Kryuchkov and L. I. Rogatina *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 254-261 refs (For availability see N73-19077 10-04)
CSCL 06K

N73-19110* Techtran Corp., Glen Burnie, Md.
PROBLEM OF THE POSSIBILITY OF USING PRODUCTS OF THE VITAL FUNCTIONING OF MAN WHICH HAVE BEEN MINERALIZED BY THE WET BURNING METHOD
V. P. Zamota, I. V. Tsvetkova, E. V. Maksimova, A. L. Agre, B. G. Gusarov, and T. V. Nolde *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 298-305 refs (For availability see N73-19077 10-04)
CSCL 06K

N73-19111* Techtran Corp., Glen Burnie, Md.
PROBLEM OF MINERALIZATION OF VEGETATIVE WASTE PRODUCTS OF A BIOCOMPLEX BY THE METHOD OF THERMAL COMBUSTION
I. V. Tsvetkova, B. G. Gusarov, V. P. Zamota, Ye. V. Maksimova, and L. A. Filatkina *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 306-310 refs (For availability see N73-19077 10-04)
CSCL 06I

N73-19112* Techtran Corp., Glen Burnie, Md.
STUDY OF A METHOD OF CONSERVATION OF URINE RELATIVE TO SPACEFLIGHT CONDITIONS
V. V. Borshchenko, V. I. Vashkov, and L. N. Rogatina *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 310-316 refs (For availability see N73-19077 10-04)
CSCL 06K

N73-19113* Techtran Corp., Glen Burnie, Md.
THE FOOD COMPONENT, BASED ON STORES OF DEHYDRATED PRODUCTS, IN LIFE SUPPORT SYSTEMS FOR CREWS OF SPACE VEHICLES DURING PROLONGED FLIGHTS
V. P. Bychkov, M. I. Kozar, N. N. Boyko, I. I. Borodulina, V. N. Gryaznova, V. S. Dupik, A. G. Kasatkina, Ye. V. Kolchin, M. V. Markaryan, and T. V. Fedotova *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 317-335 refs (For availability see N73-19077 10-04)
CSCL 06K

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-19165# Electricity Council Research Center, Capenhurst (England).
CLEANING OF SPECIMENS IN THE ELECTRON SPECTROMETER USING AN ARGON ION GUN
T. Farrell Mar. 1972 20 p
(ECRC/N486) Avail: NTIS HC $3.00

An argon ion gun was built which gives a dispersed ion beam whose energy at the sample surface is insufficient to cause structural damage, but sufficient to remove absorbed species. A description of the gun is given, together with a suggested operation procedure. The cleaning of a 60/40 Brass and of mild steel are presented as examples of the gun's capability. Author

N73-19166# Defence Research Establishment Valcartier (Quebec).
THE PRODUCTION OF O2(1DELTA g) AND O2(1 SIGMA g PLUS) IN THE REACTION OF NO WITH O3
M. Gauthier and D. R. Snelling Nov. 1972 19 p refs
(DREV Proj. 95-10-42)
(DREV-TN-2050/72) Avail: NTIS HC $3.00

High resolution spectra of the NO2 continuum emission produced from the reaction NO + O3 yields NO2 + O2 were investigated to detect any possible emission from O2(1 Delta g) at 1270 nm or O2(1 Sigma g+) at 762 nm. The photolysis of O3/O2 mixtures at 253.7 nm, which produces both states of O2 with known quantum efficiency, was used as an internal standard. From the results, it is concluded that less than 1/300 and 1/150 of the NO + O3 reactive collisions result in production of O2(1 Delta g) or O2(1 Sigma g+), respectively, at room temperature. Author

N73-19167# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
ON THE UTILITY OF THE m-6-8 POTENTIAL FUNCTION
H. J. M. Hanley and Max Klein Nov. 1972 77 p refs
(NBS Proj. 2750124; NBS Proj. 2210143)
(NBS-TN-628) Avail: SOD $0.70 as C13.46:628

The calculation of transport and equilibrium properties of

simple gases with the m-6-8 potential function is discussed. Properties referred to specifically are the viscosity, diffusion, thermal conductivity and second virial coefficients, and the thermal diffusion factor. Gases referred to are argon, krypton, xenon, nitrogen, oxygen, carbon dioxide and methane. The general behavior of a model potential with respect to the fitting of data and the selection of potential parameters are also discussed. The m-6-8 appears to be the simplest model potential which can satisfactorily be used to fit data over a wide temperature range. The relationship of the potential to independent theory is briefly examined. Author

N73-19168# North Carolina State Univ., Raleigh.
THERMODYNAMIC PROPERTIES OF UF6 AT HIGH TEMPERATURES
H. A. Hassan and Jerry E. Deese [1972] 33 p refs
Avail: NTIS HC $3.75 CSCL 07D

The equilibrium composition of the mixture resulting from the decomposition of uranium hexafluoride is calculated for temperatures ranging from 600 K to 4000 K at pressures from 0.01 atmospheres to 10 atmospheres. The species considered include UF6, UF5, UF4, U, F and F2. In addition to the composition, the thermodynamic properties of the mixture are evaluated and tabulated. The model employed for calculating the properties of UF6, UF5, and UF4 is that appropriate for a rigid rotor, harmonic oscillator model. Author

N73-19169# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
THERMAL DISSOCIATION AND RECOMBINATION OF HYDROGEN ACCORDING TO REVERSIBLE REACTION, H2 PLUS H YIELDS H PLUS H PLUS H
Ven H. Shui Oct. 1972 46 p refs
(Grant NSF GP-32522X)
(FML-Publ-72-11) Avail: NTIS HC $4.50

Three-body recombination and dissociation rate coefficients (k sub r and k sub d, respectively) for the reversible H2 + H yields H + H + H have been evaluated for temperatures ranging between 300 and 10000 K on the basis of the modified phase-space theory of reaction rates and Monte Carlo trajectory calculations. The semi-empirical Porter-Karplus surface for H3 was used in the calculations. Good agreement was obtained between the theoretical estimates of k sub d and the bulk of the dissociation rate. Possible reasons for these differences are suggested. A simple ratio was deduced which relates k of H to r and the corresponding rate coefficients of the isotopes of hydrogen. The result is in good agreement with available experimental measurements and enables one to predict the latter rate coefficients without additional trajectory calculations. An example is given to illustrate the capability of the present Monte Carlo method in obtaining other useful information about atomic and molecular collision processes. Author

N73-19170# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
FUNDAMENTAL PROPERTIES OF RE ELEMENTS AND THEIR IMPLICATIONS ON THE ANALYTICAL CHEMISTRY OF RE MATERIALS
K. A. Gschneidner, Jr. 1972 24 p refs Presented at Analysis and Appl. of Rare Earth Mater. Conf., Kjeller, Norway, 23-29 Aug. 1972 Sponsored by AEC
(IS-2966; Conf-720839-2) Avail: NTIS

The electronic configurations of the metallic state, the ground state (gaseous atoms), and the trivalent ions of the rare earth elements are given. The relationships between these configurations and the chemical and physical properties of the metals and some of the important compounds are discussed. A separate section is devoted to the spectra of the rare earth elements. Some comments are made regarding the influence some of these properties have on various analytical techniques. Author (NSA)

N73-19171# Centre National de la Recherche Scientifique, Grenoble (France).
PHYSICAL PROPERTIES OF HELIUM
J. P. Laheurte 1972 4 p refs In FRENCH; ENGLISH summary Presented at 12th Meeting on Hydraulics, Paris, 6 Jun. 1972
(FRNC-CONF-48; Conf-720648-19) Avail: AEC Depository Libraries

The physical properties of liquid helium 4, the characteristics of helium 1 and 2 (superfluid), and the Fontaine effect are described. These properties are interpreted theoretically using the Tisza model, and their effect on the use of helium as a cryogenic fluid is discussed. Author (NSA)

N73-19172# California Univ., Berkeley. Lawrence Berkeley Lab.
INTRINSIC AND EXTRINSIC NONSTOICHIOMETRY IN THE LEAD ZIRCONATE TITANATE SYSTEM Ph.D. Thesis
R. L. Holman Jul. 1972 97 p refs
(Contract W-7405-eng-48)
(LBL-880) Avail: NTIS

An investigation of the range of intrinsic and the nature of extrinsic non-stoichiometry in lead zirconate-titanate (PZT) was conducted. Methods were developed to obtain precise and reproducible control of the defect structure. The intrinsic defect structure was established by continuously weighing a PZT sample during its vapor phase equilibration with a controlled Pbo atmosphere provided by constant activity multi-phase (CAMP) PZT crucibles. Similar data was obtained by performing a modified Knudsen effusion experiment. The extrinsic defect structure associated with ionic substitutions into the PZT pervskokite lattice as well as the kinetics of solution were determined by a modified vapor phase equilibration equipment. Author

N73-19173# Danish Atomic Energy Commission, Risoe. Research Establishment.
TRANSIENT HOT-WIRE MEASUREMENT OF THE THERMAL CONDUCTIVITY OF ELECTROLYTIC SOLUTIONS
P. Barueel Jun. 1972 65 p refs
(RISO-264) Avail: AEC Depository Libraries

A modified transient hot-wire method for measurement of the thermal conductivity of liquids is proposed. This method permits measurements on all electrolytic solutions whose decomposition voltage is not quite extremely low (i.e. a few tenths of a volt). Author

N73-19174# Danish Atomic Energy Commission, Risoe. Research Establishment.
TRANSIENT HOT-WIRE DETERMINATION OF THE THERMAL CONDUCTIVITY OF PURE, DIELECTRIC LIQUIDS
Pierre Barueel Apr. 1972 65 p refs
(RISO-263) Avail: AEC Depository Libraries

Two possible sources of error are investigated: convection and a thermoelastic error which appears in certain designs of the measuring cell. The calculation method differs somewhat from the usual one because the modification made it necessary to use a hot wire of a relatively large diameter (500 microns). Author

N73-19175# Sandia Labs., Albuquerque, N.Mex.
MEASUREMENT OF TRACE COPPER IMPURITIES IN BERYLLIUM FOILS UTILIZING X-RAY FLUORESCENCE SPECTROSCOPY
J. J. Hohlfelder and K. M. Glibert Dec. 1972 15 p refs Sponsored by AEC
(SC-RR-72-0722) Avail: NTIS

The abundance of a trace copper impurity in a beryllium foil was measured by utilizing X-ray fluorescence spectroscopy. This result is compared with a destructive measurement of the copper in the same foil which utilized chemical methods. A 25-mCi 109 Cd source was used to excite the fluorescence. Author (NSA)

N73-19176# Brookhaven National Lab., Upton, N.Y.
AEROSOL CHEMISTRY
A. W. Castleman, Jr. 1972 26 p refs Presented at Chem. and Phys. of Upper Atmospheres Meeting, Orleans, France, 31 Jul. - 11 Aug. 1972 Sponsored by AEC
(BNL-17174; Conf-720721-1) Avail: NTIS

Calculations were made of aerosol dynamics and sources in the free molecular regime of the upper atmosphere. Main sources contributing aerosol concentrations include troposphere, extraterrestrial environments, and those coming from in situ formation processes. E.H.W.

N73-19177# Rocket Propulsion Establishment, Westcott (England).
THE HETEROGENEOUS DECOMPOSITION OF HYDRAZINE. PART 4: THE KINETICS OF THE DECOMPOSITION OF LIQUID HYDRAZINE ON A SUPPORTED RHODIUM CATALYST
C. F. Sayer Nov. 1972 16 p refs
(RPE-TR-71/16-Pt-4; BR-31012) Avail: NTIS HC $3.00

The kinetics of the decomposition of liquid hydrazine on a supported rhodium catalyst exhibit a change from half order for low concentrations of hydrazine to zero order for high concentrations of hydrazine. The observed kinetics was explained by deriving the rate equations from the Langmuir adsorption isotherm on the assumption that the hydrazine molecules are dissociatively adsorbed as NH2 radicals. A mechanism is postulated which involves a Langmuir-Rideal type of reaction between adsorbed radicals and a liquid phase hydrazine molecule. Author (ESRO)

N73-19178# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
SYNTHESIS AND PROPERTIES OF POLYVINYL NITRATE [DARSTELLUNG UND EIGENSCHAFTEN VON POLYVINYLENNITRATEN (PVEN)]
K. M. Bucerius 31 Dec. 1971 42 p refs In GERMAN
(ICT-7/71) Avail: NTIS HC $4.25

The manufacturing, stabilization, and propteries of polyvinyl nitrate explosives, including esterification and polymerization grades, are discussed. It was found that, theoretically a nitrogen content of 18.7% and a positive oxygen balance of ±10.7 could be obtained. The work on polyvinyl nitrate produced a contribution to the comparative study of the properties of polymeric nitric acid esters of differing constitutions, which is important with regard to the search for macromolecular explosives. ESRO

N73-19179# Tel-Aviv Univ. (Israel). Dept. of Chemical Physics.
THE NATURE OF METAL-AMMONIA SOLUTIONS
J. Jortner Jun. 1972 52 p Proc. of Colloq. Weyl 3 held in Kibbutz Hanita, Upper Galilee, Israel, 19-23 Jun. 1972
(Contract DA-ETO-591-72-G-0009; DA Proj. 200-61102-B-13B)
(AD-752915; ARDG(E)-E-1570) Avail: NTIS CSCL 07/4

The report lists the participants present and abstracts of articles presented at the Colloquim Weyl III which was devoted to theoretical and experimental studies of electrons in fluids. The major general fields covered were: Nature of metal-ammonia solutions; Excess electron in polar liquids; Excess electrons in nonpolar liquids; Electrons in polar vapors; Electronic states of disordered systems; and The metal insulator transition. GRA

N73-19180# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
NOVEL BENZOBISTRIAZOLO PHENANTHROLINE POLYMERS Final Technical Report, Jan. - Mar. 1971
Robert C. Evers Jun. 1972 24 p refs
(AD-753414; AFML-TR-72-71) Avail: NTIS CSCL 07/3

Novel, high molecular weight benzobistriazolo phenanthroline polymers were prepared by the polycondensation of 1,4,5,8-naphthalene tetracarboxylic acid with iso- or terephthaldihydrazidine dihydrochloride in polyphosphoric acid. Inherent viscosities in the range of 1.33 to 2.51 were recorded. Tough, transparent films of these polymers could be cast from methane sulfonic acid. Onset of polymer breakdown during thermogravimetric analysis in an air atmosphere occurred at 460C. Author (GRA)

N73-19181# Naval Weapons Center, China Lake, Calif.
HIGH-TEMPERATURE CONTACT NUCLEATION OF SUPERCOOLED WATER BY ORGANIC CHEMICALS AND APPENDIX OF COMPOUNDS TESTED
Aaron N. Fletcher Nov. 1972 16 p
(AD-753465; NWC-TP-5439) Avail: NTIS CSCL 07/4

The report represents the first of a series of studies concerning the heterogeneous nucleation of supercooled water. The ultimate goal is to obtain fog and cloud seeding agents with a variety of operational characteristics. Knowledge of the compounds that yield a negative test for a particular freezing process is important to scientists searching for active ice nucleating agents as it allows attention to be focused upon the more active compounds. The report contains a list of these compounds. GRA

N73-19182# Columbia Univ., New York.
GAS-PHASE OXIDATION OF ALUMINUM ATOMS Semiannual Technical Report, 1 Jan. - 30 Nov. 1972
Richard N. Zare 30 Nov. 1972 10 p refs
(Grant DA-ARO(D)-31-124-72-G174; ARPA Order 1482)
(AD-753839) Avail: NTIS CSCL 07/4

The report summarizes the authors research on gas-phase oxidation of metals, one on the detection of metal oxide products by the new technique of laser-induced fluorescence, and the other on the chemiluminescent reaction Al + O3 to AlO + O2 from which was determined. GRA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-19183 City Univ. of New York.
DIGITAL PROCESSING IN COMMUNICATION SYSTEMS Ph.D. Thesis
Joseph Garodnick 1972 144 p
Avail: Univ. Microfilms Order No. 72-24127

Three communication systems using digital processing techniques are presented and analyzed both theoretically and experimentally. The first system is an All Digital Adaptive Modulator. Delta modulation, DM, is a one bit differential source encoder that saves bandwidth at the expense of dynamic range. Experimental results are obtained for pseudo-random data inputs, squarewave inputs, sinewave inputs as well as for human voice. The second system is an All Digital FM Discriminator. Both theoretical and experimental results for the output signal-to-noise ratios versus input carrier-to-noise ratios are obtained. The results include the effects of thermal noise, impulse noise, and quantization noise. Finally, an All Digital Phase Locked Loop, DPLL, used for FM demodulation, is analyzed, designed, and constructed. The restrictions imposed by the digital circuitry necessitate the invention of new algorithms to allow the DPLL to operate in real-time. The performance of the system in response to FM signals is determined theoretically and experimentally. Dissert. Abstr.

N73-19184*# New Mexico State Univ., Las Cruces. Communication Research Group.
ADVANCED STUDY OF VIDEO SIGNAL PROCESSING IN LOW SIGNAL TO NOISE ENVIRONMENTS Semiannual Progress Report, Dec. 1971 - May 1972
Frank Carden and Robert Henry 21 Dec. 1972 31 p refs
(Grant NGR-32-003-037)
(NASA-CR-131237) Avail: NTIS HC $3.75 CSCL 17B

A nonlinear analysis of a multifilter phase-lockloop (MPLL) by using the method of harmonic balance is presented. The particular MPLL considered has a low-pass filter and a band-pass filter in parallel. An analytic expression for the relationship between the input signal phase deviation and the phase error is determined for sinusoidal FM in the absence of noise. The expression is used to determine bounds on the proper operating region for the MPLL and to investigate the jump phenomenon previously observed. From these results the proper modulation index, modulating frequency, etc. used for the design of a MPLL are determined. Data for the loop unlock boundary obtained from the theoretical expression are compared to data obtained from analog computer simulations of the MPLL. Author

N73-19185*# City Univ. of New York. Communications Systems Lab.
DELTA MODULATION Final Report, 1 Jan. - 31 Dec. 1972
Donald L. Schilling 31 Dec. 1972 27 p refs
(Grant NGR-33-013-063)
(NASA-CR-131228) Avail: NTIS HC $3.50 CSCL 17B

The results are presented of a study dealing with the problems

of source encoding using delta modulation. An algorithm is described which was employed in the design of an adaptive delta modulation. The algorithm is extremely inexpensive to implement and features extremely desirable characteristics such as a 40 db dynamic range and a 90 percent non-redundant word intelligibility at a bit rate of 9.6 kb/s. A new concept is presented in delta modulation design, the nth-order delta modulator. The nth order delta modulator increases the maximum SNR of a delta modulator but not its dynamic range. It is shown that a 2nd order delta modulator, which employs two delta modulators in cascade, results in a 15 db output SNR improvement over a linear delta modulator operating at 27 db. Two additional areas of research are discussed. The first area involves decomposition of voice and the second is concerned with the source encoding of video signals. D.L.G.

N73-19186# Joint Publications Research Service, Arlington, Va.
MONITORING NORTHERN HEMISPHERE TRANSMISSIONS IN ANTARCTICA AND SOME OBLIQUE SOUNDING SYSTEMS
12 Feb. 1973 34 p refs Transl. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchn.-Issled. (Leningrad), v. 280, 1966 p 115-126, 140-151
(JPRS-58205) Avail: NTIS HC $3.75

An analysis of the peculiarities of shortwave transmissions between Antarctica and the Northern Hemisphere is discussed along with a survey of some oblique sounding systems and the selection of a system for practical applications. For individual titles, see N73-19187 through N73-19188.

N73-19187 Joint Publications Research Service, Arlington, Va.
PECULIARITIES OF SHORTWAVE TRANSMISSION BETWEEN ANTARCTICA AND THE NORTHERN HEMISPHERE
V. M. Driatskiy *In its* Monitoring Northern Hemisphere Transmissions in Antarctica and Some Oblique Sounding Systems 12 Feb. 1973 p 1-16 refs (For availability see N73-19186 10-07)

The peculiarities were investigated of shortwave propagation over the long distance radio links connecting Antarctica with the Northern Hemisphere. Data from observations conducted at Mirnyy in 1961 on the reception quality of Pearl Harbor and New York radio stations were used as a basis for the study. The data indicate that a direct relationship exists between radiowave transmission dependability and exposure of the radio link to sunshine. This implication and other phenomena were subjected to a thorough analysis. The results of the analysis are given and their significance discussed. D.L.G.

N73-19188 Joint Publications Research Service, Arlington, Va.
SURVEY OF SOME OBLIQUE SOUNDING SYSTEMS AND SELECTION OF A SYSTEM FOR PRACTICAL APPLICATION
A. I. Taranov *In its* Monitoring Northern Hemisphere Transmissions in Antarctica and Some Oblique Sounding Systems 12 Feb. 1973 p 17-31 refs (For availability see N73-19186 10-07)

Three specific types of oblique sounding systems are characterized: a manual discrete-frequency system, an automatic sweep-frequency system, and an automatic discrete-frequency system. In addition, some parameters of the systems used in the U.S. and Canada are examined. Factors for consideration in selecting an oblique sounding system are defined along with system component characteristics. D.L.G.

N73-19189# Communications Research Centre, Ottawa (Ontario).
INTERMODULATION ANALYSIS OF NONLINEAR DEVICES FOR MULTIPLE CARRIER INPUTS M.S. Thesis - Carleton Univ.
Michel J. Eric Nov. 1972 72 p refs
(CRC-1234) Avail: NTIS HC $5.75

In numerous communication systems, inputs consisting of many modulated carriers are passed through devices which exhibit both amplitude and phase non-linearities. This report is concerned with the analysis and computation of the effects of such devices on bandpass signals consisting of a moderate number of modulated sine waves, where the non-linear device is wide-band in comparison with the signal. Such device may be characterized by measurements of its single-carrier amplitude and phase transfer functions, and is modeled here by a quadrature structure which includes two non-linearities each of which, acting on its own, would exhibit only amplitude distortion. Author

N73-19190*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SUCCESSIVE OVERRELAXATION ITERATIVE TECHNIQUE FOR AN ADAPTIVE EQUALIZER
Ostap S. Kosovych Washington Mar. 1973 55 p refs
(NASA-TR-R-402; G-1075) Avail: NTIS HC $3.00 CSCL 17B

An adaptive strategy for the equalization of pulse-amplitude-modulated signals in the presence of intersymbol interference and additive noise is reported. The successive overrelaxation iterative technique is used as the algorithm for the iterative adjustment of the equalizer coefficents during a training period for the minimization of the mean square error. With 2-cyclic and nonnegative Jacobi matrices substantial improvement is demonstrated in the rate of convergence over the commonly used gradient techniques. The Jacobi theorems are also extended to nonpositive Jacobi matrices. Numerical examples strongly indicate that the improvements obtained for the special cases are possible for general channel characteristics. The technique is analytically demonstrated to decrease the mean square error at each iteration for a large range of parameter values for light or moderate intersymbol interference and for small intervals for general channels. Analytically, convergence of the relaxation algorithm was proven in a noisy environment and the coefficient variance was demonstrated to be bounded. Author

N73-19191*# Planar Corp., Washington, D.C.
A SYSTEM FOR ANALYSIS AND CLASSIFICATION OF VOICE COMMUNICATIONS
Harry J. Older, Larry L. Jenney, and Louise Garland Feb. 1973 66 p refs
(Contract NAS9-12867)
(NASA-CR-128837) Avail: NTIS HC $5.50 CSCL 17B

A method for analysis and classification of verbal communications typically associated with manned space missions or simulations was developed. The study was carried out in two phases. Phase 1 was devoted to identification of crew tasks and activities which require voice communication for accomplishment or reporting. Phase 2 entailed development of a message classification system and a preliminary test of its feasibility. The classification system permits voice communications to be analyzed to three progressively more specific levels of detail and to be described in terms of message content, purpose, and the participants in the information exchange. A coding technique was devised to allow messages to be recorded by an eight-digit number. Author

N73-19192*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
GROUND-COMMANDED TELEVISION ASSEMBLY (GCTA) Interim Final Report, 31 Jul. 1970 - 15 Feb. 1972
25 Feb. 1972 77 p
(Contract NAS9-11260)
(NASA-CR-128829; R-3838F) Avail: NTIS HC $6.00 CSCL 09F

A ground-commanded color television assembly (GCTA) was designed for use on lunar explorations associated with NASA manned Apollo missions. The camera system as seen on Apollo 15 provided television coverage in the vicinity of the lunar module (LM) landing site, and was mounted on the lunar roving vehicle (LRV) to provide color coverage of astronaut activity and lunar topography during traverses on the surface. Remote control of the camera from earth was accomplished through the existing real-time Apollo command links. The assembly is illustrated. The configuration satisfied all anticipated requirements of the Apollo 15 mission and was fully responsive to specifications. The technical approach was based on proven designs and offered maximum mission flexibility, potential growth, and capability to withstand environmental extremes encountered on the lunar surface.
Author

N73-19193*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER 9 TELEVISION PICTURES: MICROFICHE LIBRARY USER'S GUIDE. MTC/MTVS REAL-TIME

PICTURES
R. A. Becker 15 Feb. 1973 18 p refs
(Contract NAS7-100)
(NASA-CR-130925; JPL-TM-33-595) Avail: NTIS HC $3.00 CSCL 09F

This document describes the content and organization of the Mariner 9 Mission Test Computer/Mission Test Video System microfiche library. This 775 card library is intended to supply the user with a complete record of the images received from Mars orbit during the Mariner 9 mission operations, from 15 Nov. 1971 to 1 Nov. 1972. Author

N73-19194*# Radio Corp. of America, Camden, N.J. Defense Communications System Div.
DESIGN STUDY REPORT. VOLUME 1: TRANSPORT UNIT
Feb. 1973 370 p
(Contract NAS5-11643)
(NASA-CR-130186) Avail: NTIS HC $20.50 CSCL 14C

Results are presented of mechanical and thermal analyses of the transport mechanism and its pressurized enclosure, and electrical and thermal analyses of those circuits within the enclosure. Author

N73-19195*# Radio Corp. of America, Camden, N.J. Communications Systems Div.
DESIGN STUDY REPORT. VOLUME 2: ELECTRONIC UNIT
Feb. 1973 716 p
(Contracts NAS5-11643; NAS5-11288)
(NASA-CR-130187) Avail: NTIS HC $38.00 CSCL 14C

The recording system discussed is required to record and reproduce wideband data from either of the two primary Earth Resources Technology Satellite sensors: Return Beam Vidicon (RBV) camera or Multi-Spectral Scanner (MSS). The camera input is an analog signal with a bandwidth from dc to 3.5 MHz; this signal is accommodated through FM recording techniques which provide a recorder signal-to-noise ratio in excess of 39 db, black-to-white signal/rms noise, over the specified bandwidth. The MSS provides, as initial output, 26 narrowband channels. These channels are multiplexed prior to transmission, or recording, into a single 15 Megabit/second digital data stream. Within the recorder, the 15 Megabit/second NRZL signal is processed through the same FM electronics as the RBV signal, but the basic FM standards are modified to provide an internal, 10.5 MHz baseland response with signal-to-noise ratio of about 25 db. Following FM demodulation, however, the MSS signal is digitally re-shaped and re-clocked so that good bit stability and signal-to-noise exist at the recorder output. Author

N73-19196# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
SOME DEVELOPMENT IN FAST ELECTRONICS IN SIGNAL PROCESSING
Jacques Mey 12 Apr. 1972 11 p refs In FRENCH Presented at the Half-Day Conf. on the Treatment of the Ultrafast Transient Signal, Saclay, France, 12 Apr. 1972
(CEA-CONF-1897; Conf-720452-5) Avail: AEC Depository Libraries

Three recent developments in fast electronics in signal processing are briefly described. These are a numerical analyzer of signals with minimum rise time of 2 nsec, a chronometer with a precision better than 10-4 for time intervals of 100 microsec and + or -300 psec for short intervals less than 1 microsec, and a real fast time multicorrelator. NSA

N73-19197# Sandia Labs., Albuquerque, N.Mex.
POWER DENSITY SPECTRUM OF THE TERRAIN ECHO OF A MOVING RADAR
E. A. Aronson and C. S. Williams Jun. 1972 28 p refs Sponsored by AEC
(SC-RR-72-0265) Avail: NTIS

The variation of radar altimeter return from the terrain due to radar motion may be statistically described by a power density spectrum. A method is derived that eliminates the first approximation by including the effect of change of the complex reflection coefficient of the scattering points with viewing aspect, and eliminates the second by finding and Fourier-transforming the autocorrelation function of the total echo. The formula for the spectrum obtained by this correct method shows that it spreads into the frequency region where the conventional method predicts it to be zero. Author

N73-19198# Selenia S.p.A., Rome (Italy).
RENDEZVOUS AND DOCKING RADAR SYSTEM STUDY ELDO Space Shuttle Technology Program Final Report
[1972] 171 p refs
(Contract ELDO-CTR-17/6/61)
Avail: NTIS HC $10.75

Results are presented of a theoretical study to determine a rendezvous and docking system concept for the space shuttle which meets the performance autonomy and reliability requirements. Laser techniques, deemed the most suitable, are considered. The system components are described, and the results of a survey among European manufacturers are given. Computer simulation of a tracking unit operation and data smoothing procedures are also discussed. ESRO

N73-19199# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELF PROPAGATION MEASUREMENTS AT NORWAY, SAIPAN AND GREECE (PHASE 4 - SPRING 1972)
D. P. White 7 Dec. 1972 44 p refs
(Contract F19628-73-C-0002; AF Proj. 1508A)
(AD-753685; TN-1972-37; ESD-TR-72-339) Avail: NTIS CSCL 20/14

A fourth set of ELF propagation measurements has been undertaken to determine a set of initial signal statistics for propagation in the 40 and 70 Hz bands. The test period was from May 1-19, 1972. The transmitter radiated simple sinusoidal signals on a continuous (24 hour) basis, changing frequency on a daily or every other day basis. For the first time we have investigated the time period during which the sunrise or sunset terminator intercepts the propagation path. Receiver sites were located in Norway, Greece and Saipan. Author (GRA)

N73-19200# SACLANT ASW Research Center, La Spezia (Italy).
SHADZO: A COMPUTER PROGRAM FOR ESTIMATING THE POSITION AND SHAPE OF THE SURFACE SHADOW ZONE IN SONAR OPERATIONS
Bernard DeRaigniac and John Padley 15 Jan. 1972 46 p refs
(AD-753443; SACLANTCEN-TM-183) Avail: NTIS CSCL 17/1

SHADZO is a composite program which calculates the position and shape of the first surface shadow zone as a function of the source depth for a given sound speed profile. The program is small enough to be run on a shipboard mini-computer in a few minutes. Author (GRA)

N73-19201# Naval Postgraduate School, Monterey, Calif.
THE APPLICATION OF THE KALMAN FILTER TO THE SONOBUOY REFERENCE SYSTEM ON THE S3A M.S. Thesis
Sammy Dean Stair Sep. 1972 33 p refs
(AD-753608) Avail: NTIS CSCL 15/1

In 1960 R. E. Kalman introduced a least square concept that gives optimal estimates for the state of some dynamic systems. Included is a brief historical introduction leading to his work, a summary of his work, and the application of the theory to the sonobuoy reference system used on the S3A aircraft. Also, a tutorial development of certain quantities used in the filter is presented. Author (GRA)

N73-19202# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECORDING THE STRUCTURE OF LASER RADIATION IN THE 10.6 MICROMETER BAND ON THIN MAGNETIC FILM
L. M. Klyukin, B. M. Stephanov, V. A. Fabrikov, I. A. Khripchenko, E. A. Chernov, and B. B. Shvartsman 24 Nov. 1972 9 p refs Transl. into ENGLISH from ZH. Nauch. Prikl. Fotogr. Kinematogr. (Moscow), no. 5, 1971 p 369-370
(AF Proj. 7645)
(AD-753962; FTD-HT-23-1240-72) Avail: NTIS CSCL 14/5

Experiments are described in which laser light structures were studied by exposure of 0.29 micrometer Ni-Fe films to continuous laser light in the infrared. Cross sectional images of laser beams, made visible on the magnetic colloid of the films, were photographed at different angles during these experiments. Author (GRA)

N73-19983* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
ON THE FEASIBILITY OF EFFICIENT MULTIAMPLITUDE COMMUNICATION
J. G. Smith *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 62-71 refs (For availability see N73-19975 10-34)
CSCL 17B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-19203*# Martin Marietta Corp., Denver, Colo.
PROTOTYPE DATA TERMINAL: MULTIPLEXER/DEMULTIPLEXER Final Report (operations manual)
D. E. Leck and J. E. Goodwin Dec. 1972 204 p Revised (Contract NAS8-27538)
(NASA-CR-124127; MCR-72-123-Rev-A) Avail: NTIS HC $12.25 CSCL 09B

The design and operation of a quad redundant data terminal and a multiplexer/demultiplexer (MDU) design are described. The most unique feature is the design of the quad redundant data terminal. This is one of the few designs where the unit is fail/op, fail/op, fail/safe. Laboratory tests confirm that the unit will operate satisfactorily with the failure of three out of four channels. Although the design utilizes state-of-the-art technology. The waveform error checks, the voting techniques, and the parity bit checks are believed to be used in unique configurations. Correct word selection routines are also novel, if not unique. The MDU design, while not redundant, utilizes, the latest state-of-the-art advantages of light couplers and integrated circuit amplifiers. Author

N73-19204*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATED METHODS OF COMPUTER PROGRAM DOCUMENTATION
Nov. 1970 245 p refs Presented at the Proc. of a Symp. at Greenbelt, Md., 3-4 Nov. 1970
(NASA-TM-X-66196; X-543-73-62) Avail: NTIS HC $14.25 CSCL 09B

Conference papers are presented which cover a broad area of possible methods for automated documentation of computer programs. For individual titles, see N73-19205 through N73-19224.

N73-19205* Computer Sciences Corp., Los Angeles, Calif.
PROGRAM DOCUMENTATION WITH ADVANCED DATA MANAGEMENT SYSTEMS
Wayne B. Swift *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 3-7 (For availability see N73-19204 10-08)
CSCL 09B

The problems of program documentation are considered for those cases in which the programmer is using a computer along with an advanced DMS. Three problem areas discussed include: data description, process description, and execution-time documentation. D.L.G.

N73-19206* Applied Data Research, Inc., Washington, D.C.
AUTOFLOW ENHANCEMENTS FOR DOCUMENTATION AND MAINTENANCE OF SCIENTIFIC APPLICATIONS
Martin A. Goetz *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 9-31 (For availability see N73-19204 10-08)
CSCL 09B

The use of the AUTOFLOW system is discussed in terms of improving automated documentation. Flowcharts produced by AUTOFLOW are considered to be much more meaningful than those produced manually in that they are accurate, present complete references between all transfer points, and graphically portray the logical flow by automatic rearrangement of those segments of the program that interact. D.L.G.

N73-19207* Bell Telephone Labs., Inc., New York.
THE BELLFLOW SYSTEM
Stephen Pardee *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 33-42 (For availability see N73-19204 10-08)
CSCL 09B

The BELLFLOW flowcharting system was developed to meet certain Bell System standards of documentation. There are three modes of operation with the BELLFLOW system: source mode, comment mode, and mixed mode. In the source mode, all of the flowcharting information is derived directly from the source code. In the comment mode, BELLFLOW ignores the source code completely and derives the entire flowchart purely from comments imbedded in the program. In the mixed mode, the source and comment mode are combined. The mixed mode is unique to BELLFLOW and was designed to provide a self-documenting program source deck. Other features of BELLFLOW include: automatic placement, automatic line routing, paging, and generation of on and off sheet connectors. D.L.G.

N73-19208* Grumman Data Systems Corp., Bethpage, N.Y.
AN AUTOMATED SYSTEM FOR GENERATING PROGRAM DOCUMENTATION
Richard J. Hanney *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 43-60 (For availability see N73-19204 10-08)
CSCL 09B

A documentation program was developed in which the emphasis is placed on text content rather than flowcharting. It is keyword oriented, with 26 keywords that control the program. Seventeen of those keywords are recognized by the flowchart generator, three are related to text generation, and three have to do with control card and deck displays. The strongest advantage offered by the documentation program is that it produces the entire document. The document is prepared on 35mm microfilm, which is easy to store, and letter-size reproductions can be made inexpensively on bond paper. D.L.G.

N73-19209* Computer Sciences Corp., Los Angeles, Calif.
THE INTEGRATION OF SYSTEM SPECIFICATIONS AND PROGRAM CODING
William R. Luebke *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 61-74 (For availability see N73-19204 10-08)
CSCL 09B

Experience in maintaining up-to-date documentation for one module of the large-scale Medical Literature Analysis and Retrieval System 2 (MEDLARS 2) is described. Several innovative techniques were explored in the development of this system's data management environment, particularly those that use PL/I as an automatic documenter. The PL/I data description section can provide automatic documentation by means of a master description of data elements that has long and highly meaningful mnemonic names and a formalized technique for the production of descriptive commentary. The techniques discussed are practical methods that employ the computer during system development in a manner that assists system implementation, provides interim documentation for customer review, and satisfies some of the deliverable documentation requirements. Author

N73-19210* National Bureau of Standards, Washington, D.C.
VIEWS ON COMPUTER PROGRAM DOCUMENTATION AND AUTOMATION
Herbert R. Grosch *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 77-79 (For availability see N73-19204 10-08)
CSCL 09B

Various aspects of the problem of program documentation and description are discussed. Particular emphasis is placed on the problem of semantics. It is pointed out that the information produced by documentation of a program, if presented to several different groups, may mean entirely different things to these groups. Recognition of the fact that people look at problems differently is proposed as a more practical approach to the problem of documentation rather than extensive use of standards or strict formatting. The difficulties involved in searching for ways to provide a common ground for the transmission and use of information are discussed. D.L.G.

N73-19211* Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
AUTOMATIC EDITING OF MANUALS
Robert P. Rich *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 81-85 (For availability see N73-19204 10-08)
CSCL 09B

The documentation problem is discussed that arises in getting all the many items included in a computer program prepared in a timely fashion and keeping them all correct and mutually consistent during the life of the program. The proposed approach to the problem is to collect all the necessary information into a single document, which is maintained with computer assistance during the life of the program and from which the required subdocuments can be extracted as desired. Implementation of this approach requires a package of programs for computer editorial assistance and is facilitated by certain programming practices that are discussed. Author

N73-19212* System Development Corp., Santa Monica, Calif.
MAKING AUTOMATED COMPUTER PROGRAM DOCUMENTATION A FEATURE OF TOTAL SYSTEM DESIGN
Allan W. Wolf *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 87-104 (For availability see N73-19204 10-08)
CSCL 09B

It is pointed out that in large-scale computer software systems, program documents are too often fraught with errors, out of date, poorly written, and sometimes nonexistent in whole or in part. The means are described by which many of these typical system documentation problems were overcome in a large and dynamic software project. A systems approach was employed which encompassed such items as: (1) configuration management; (2) standards and conventions; (3) collection of program information into central data banks; (4) interaction among executive, compiler, central data banks, and configuration management; and (5) automatic documentation. A complete description of the overall system is given. D.L.G.

N73-19213* International Business Machines Corp., New York.
SYNTAX-DIRECTED DOCUMENTATION FOR PL360
Harlan D. Mills *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 105-116 refs (For availability see N73-19204 10-08)
CSCL 09B

PL360 is a phrase-structured programming language which provides the facilities of a symbolic machine language for the IBM 360 computers. An automatic process, syntax-directed documentation, is described which acquires programming documentation through the syntactical analysis of a program, followed by the interrogation of the originating programmer. This documentation can be dispensed through reports of file query replies when other programmers later need to know the program structure and its details. A key principle of the programming documentation process is that it is managed solely on the basis of the syntax of programs. Author

N73-19214* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION: MOTIVATION AND TRAINING OR AUTOMATION
Melba L. Mouton *In its* Automated Methods of Computer Program Doc. Nov. 1970 p 117-127 refs (For availability see N73-19204 10-08)
CSCL 09B

The road blocks and mental blocks in areas where automation is not taking care of basic documentation problems are discussed. Original project documentation, documentation for project maintenance, and comparison of preliminary and final documentation are described. The use of flow charts is also mentioned. J.A.M.

N73-19215* Georgia Univ., Athens.
COSMIC PROGRAM DOCUMENTATION EXPERIENCE
Martha C. Kalar *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 131-139 (For availability see N73-19204 10-08)
CSCL 09B

A brief history of COSMIC as it relates to the handling of program documentation is summarized; the items that are essential for computer program documentation are also discussed. COSMIC documentation and program standards handbook is appended. J.A.M.

N73-19216* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATED DOCUMENTATION OF AN ASSEMBLY PROGRAM
Valerie L. Thomas *In its* Automated Methods of Computer Program Doc. Nov. 1970 p 141-146 (For availability see N73-19204 10-08)
CSCL 09B

A program is discussed that can be used as input to another program which will automatically document it. This program was implemented using assembly language program, META-SYMBOL, on XDS 930 computer. The characteristics and identification of the documentation program, DOCMNT, are described. J.A.M.

N73-19217* Computer Sciences Corp., Los Angeles, Calif.
AUTODOCUMENTATION
Jay Arnold *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 147-155 (For availability see N73-19204 10-08)
CSCL 09B

Automated documentation systems with expanded capabilities for reusing existing programs are considered by allowing a relatively inexpensive determination of program capabilities. A theoretical approach to such a system is proposed. Tree structure variations are examined, along with assignment statements, conditional branches, loops, and an automated analyzer. J.A.M.

N73-19218* Litton Systems, Inc., Beverly Hills, Calif.
COST ADVANTAGES OF AN INTEGRATED DOCUMENTATION APPROACH
William O. Felsman *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 157-166 (For availability see N73-19204 10-08)
CSCL 05B

Interactive use of on-line computing terminals for updating programs is discussed. An integrated documentation approach using predocumented subroutines and metaprogram techniques is found to be an efficient means of generating the relevant documentation and of reducing program development costs. J.A.M.

N73-19219* Aries Corp., McLean, Va.
AUTOMATIC PROGRAM ANNOTATION (AUTONOTE)
Michael D. Neely and Judy W. Tyson *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 167-184 (For availability see N73-19204 10-08)
CSCL 09B

A preliminary identification of tools that can be used in the documentation process is described. Some areas of program documentation are identified for automation. The assembly language program is emphasized. J.A.M.

N73-19220* TRW Systems Group, Redondo Beach, Calif.
PROGRAM AUTOMATED DOCUMENTATION METHODS
Bernadine C. Lanzano *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 187-205 (For availability see N73-19204 10-08)
CSCL 05B

The mission analysis and trajectory simulation program is summarized; it provides an understanding of the size and complexity of one simulation for which documentation is mandatory. Programs for automating documentation of subroutines, flow charts, and internal cross reference information are also included. J.A.M.

N73-19221* Softech, Inc., Waltham, Mass.
AUTOMATED ENGINEERING DESIGN (AED); AN APPROACH TO AUTOMATED DOCUMENTATION
Charles W. McClure *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 207-212 (For availability see N73-19204 10-08)

CSCL 09B

The automated engineering design (AED) is reviewed, consisting of a high level systems programming language, a series of modular precoded subroutines, and a set of powerful software machine tools that effectively automate the production and design of new languages. AED is used primarily for development of problem and user-oriented languages. Software production phases are diagramed, and factors which inhibit effective documentation are evaluated. J.A.M.

N73-19222* Programming Methods, Inc., Silver Spring, Md.
PROGRAM ANALYSIS FOR DOCUMENTATION
G. H. Lolmaugh *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 213-221 (For availability see N73-19204 10-08)
CSCL 09B

A program analysis for documentation (PAD) written in FORTRAN has three steps: listing the variables, describing the structure and writing the program specifications. Technical notes on editing criteria for reviewing program documentation, technical notes for PAD, and FORTRAN program analyzer for documentation are appended. J.A.M.

N73-19223* Maryland Univ., College Park.
TREE-STRUCTURED INFORMATION FILE AND ITS SUBPROGRAM SUBTREE
Charles K. Mesztenyi *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 223-243 (For availability see N73-19204 10-08)
CSCL 09B

Development documentation programs are considered. A document tree is defined as the syntactic representation of a document when it is divided into subdivisions such as chapters and sections; a developmental tree is also defined as a tree of information obtained during the course of the development of the computer program. A developmental subtree is emphasized and described. A printed subprogram is also included. J.A.M.

N73-19224* Sperry Rand Corp., St. Paul, Minn. UNIVAC.
A SCAN PROCESSOR AS AN AID TO PROGRAM DOCUMENTATION
Paul Oliver *In* NASA. Goddard Space Flight Center Automated Methods of Computer Program Doc. Nov. 1970 p 245-255 refs (For availability see N73-19204 10-08)
CSCL 09B

Program documentation was separated into two catagories: documentation for program use and documentation for program analysis, modification, or extension. The symbol scanner, flow chart production subsystem, decision table subsystem, and scan processor are also described. J.A.M.

N73-19225*# Burroughs Corp., Paoli, Pa. Defense, Space and Special Systems Group.
ILLIAC 4 SYSTEMS CHARACTERISTICS AND PROGRAMMING MANUAL
Washington NASA Feb. 1973 363 p Sponsored in part by NASA and ARPA
(Contract AF 30(602)-4144)
(NASA-CR-2159) Avail: NTIS HC $6.00 CSCL 09B

The latest edition is presented of the Systems Characteristics and Programming Manual of the ILLIAC 4 array and parallel disc memory system. The major aspects of the array described include: the array systems characteristics, programming characteristics, definition and flow charts, and timing. A glossary of terms, and an instruction index are included. Author

N73-19226# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
ANALOG RECORDING OF NON-RECURRENT SIGNALS [ENREGISTREUR ANALOGIQUE DE SIGNAUX NON-RECURRENTS]
J. P. Perotti Dec. 1972 14 p refs In FRENCH
(LRP-57/72) Avail: NTIS HC $3.00

A waveform digitizer is described which allows one to record waveforms by consecutively sampling the amplitude of the input signal at 10 n sec intervals. The 200 samples are converted into digital numbers and stored in a memory. Author

N73-19227*# Rice Univ., Houston, Tex. Lab. for Computer Science and Engineering.
FEASIBILITY INVESTIGATION OF A CELLULARLY ORGANIZED DATA PROCESSOR
Robert C. Minnick, J. Robert Jump, Robert G. Arnold, and John M. Beirne 30 Sep. 1972 68 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953246)
(NASA-CR-130936) Avail: NTIS HC $5.50 CSCL 09B

The application of cellular arrays to NASA missions was studied. Cellular arrays are iterative logical and memory structures which can be programmed to accomplish a wide variety of logical tasks. Used in long-duration space missions, spare cellular arrays can be remotely programmed to replace faulty logical subsystems as the need arises. Author

N73-19228*# Philco-Ford Corp., Houston, Tex. WDL Div.
DISPLAY FORMATS MANUAL
R. L. Runnels 12 Jan. 1973 167 p refs
(Contract NAS9-1261)
(NASA-CR-128843; PHO-TR515) Avail: NTIS HC $10.50 CSCL 09B

The standards and procedures for the generation of operational display formats to be used in the Mission Control Center (MCC) display control system are presented. The required effort, forms, and fundamentals for the design, specifications, and production of display formats are identified. The principles of display design and system constraints controlling the creation of optimum operational displays for mission control are explained. The basic two types of MCC display systems for presenting information are described. Author

N73-19229*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SCIENTIFIC DATA REDUCTION AND ANALYSIS PLAN: PI SERVICES
Paul D. Feldman and Wm. G. Fastie 27 Sep. 1971 61 p
(Contract NAS9-11528)
(NASA-CR-128836) Avail: NTIS HC $5.25 CSCL 05B

This plan comprises two parts. The first concerns the real-time data display to be provided by MSC during the mission. The prime goal is to assess the operation of the UVS and to identify any problem areas that could be corrected during the mission. It is desirable to identify any possible observations of unusual scientific interest in order to repeat these observations at a later point in the mission, or to modify the time line with respect to the operating modes of the UVS. The second part of the plan discusses the more extensive postflight analysis of the data in terms of the scientific objectives of this experiment. Author

N73-19230*# Sperry Rand Corp., Huntsville, Ala. Space Support Div.
COMPUTERIZED LOGIC DESIGN OF DIGITAL CIRCUITS
Sidney Sussow and Rodney Oglesby Washington NASA Mar. 1973 166 p refs
(Contract NAS8-21812)
(NASA-CR-2212; Rept-275-0678) Avail: NTIS HC $3.00 CSCL 09B

This manual presents a computer program that performs all the work required for the logic design of digital counters or sequential circuits and the simplification of Boolean logic expressions. The program provides both the experienced and inexperienced logic designer with a comprehensive logic design capability. The manual contains Boolean simplification and sequential design theory, detailed instructions for use of the program, a large number of illustrative design examples, and complete program documentation. Author

N73-19231# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
AUTOMATIC DATA ACQUISITION USING A DESK CALCULATOR
T. L. Futrell 17 Nov. 1972 15 p
(Contract W-7405-eng-26)
(Y-1854) Avail: NTIS

A system has been designed that permits automatic data acquisition and processing using a programmable electronic desk calculator. By using a calculator which is not promoted for its interfacing capabilities, but which has provisions for remote entry

of data, a relatively simple, inexpensive system has been fabricated. The unit is now in production use on an X-ray spectrometer which has been updated with solid state nuclear instrument module system counting equipment. Author (NSA)

N73-19232# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
DESIGN AND DEVELOPMENT OF INTEGRATED TOROIDAL MAGNETIC MEMORIES Progress Report [ETUDE ET REALISATION D'UNE MEMOIRE MAGNETIQUE A TORES INTEGRES RAPPORT D'AVANCEMENT DES ETUDES DE REALISATION ET DES RESULTATS OBTENUS]
P. Girault, R. Ponnet, and G. Valembois 28 May 1972 14 p In FRENCH
(Rept-1541) Avail: NTIS HC $3.00

High capacity magnetic storage devices were designed. Tests have shown the presence of defects in the form of short circuits between different points in the stacks. Their influence on the capacity of the storage devices is discussed. Technological problems encountered during development are listed, and possible improvements are suggested. ESRO

N73-19233# Montecatini Edison S.p.A., Milan (Italy). System Engineering Section.
SPACE SHUTTLE TECHNOLOGY STUDY: DATA DISTRIBUTION SUBSYSTEM (PHASE 1 STUDY) Final Report
30 Nov. 1971 97 p
(Contract ELDO-CTR-71/6/60)
(NT-SES/11/71/030) Avail: NTIS HC $7.00

The results of work done since the end of April 1971 on the possible implementation of a data distribution subsystem (DDS) for use on board the space shuttle vehicle or other space vehicles of the post Apollo program are described. The reference environmental conditions under which the on-board equipment must operate are summarized and the problems encountered are described. Several solutions appear to be feasible, among which one in particular exhibits rather attractive features. ESRO

N73-19982* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Data Systems Div.
INFORMATION MANAGEMENT SYSTEM FOR THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD (SWRCB)
T. C. Heald and G. H. Redmann *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 53-61 (For availability see N73-19975 10-34)
CSCL 05B

N73-19573* Scientific Translation Service, Santa Barbara, Calif.
A METHOD OF USING A DIGITAL COMPUTER FOR CONTROLLING INSTRUMENTS ABOARD SPACECRAFT
L. N. Lupichev, Yu. K. Khodarev, and I. V. Shamanov *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 1-24 refs (For availability see N73-19572 10-19)
CSCL 09B

N73-19574* Scientific Translation Service, Santa Barbara, Calif.
A PROGRAM FOR REALIZING THE FUNCTIONS OF THE PROGRAM-SEQUENCING DEVICE ON AN ON-BOARD DIGITAL COMPUTER USED IN THE CONTROL SYSTEM GOVERNING THE EQUIPMENT ABOARD SPACECRAFT
I. V. Shamanov *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 25-42 ref (For availability see N73-19572 10-19)
CSCL 09B

N73-19575* Scientific Translation Service, Santa Barbara, Calif.
A PROBABILISTIC MODEL OF CONTROL DIGITAL COMPUTERS FOR THE PURPOSE OF ESTIMATING THE EFFECTIVENESS OF THE COMMUNICATION BETWEEN A DIGITAL COMPUTER AND INFORMATION SOURCES AND RECEIVERS
Ye. I. Ruchka *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 43-72 refs (For availability see N73-19572 10-19)
CSCL 09B

N73-19576* Scientific Translation Service, Santa Barbara, Calif.
AN ANALYSIS OF A CONTROL DIGITAL COMPUTING COMPLEX AS A MULTISTAGE SYSTEM OF MASS SERVICING
Ye. I. Ruchka *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 73-88 refs (For availability see N73-19572 10-19)
CSCL 09B

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-19234* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLURAL BEAM ANTENNA Patent
George C. Keller, Marvin S. Maxwell, and Louis R. Dod, inventors (to NASA) Issued 23 Jan. 1973 7 p Filed 22 Nov. 1971
(NASA-Case-GSC-11013-1; US-Patent-3,713,163; US-Patent-Appl-SN-200717; US-Patent-Class-343-754; US-Patent-Class-343-839; US-Patent-Class-343-854; US-Patent-Class-343-895) Avail: US Patent Office CSCL 09E

An antenna capable of deriving several beams about a single boresight axis including a focusing means, such as a parabolic reflector or a lens is described. Plural arrays, each including plural radially aligned antenna elements extending from the boresight axis, are located in proximity to a focal point for the focusing means. The elements of the plural arrays are independently excited as each of the arrays is independently rotated about the boresignt axis.
Official Gazette of the U.S. Patent Office

N73-19235* Westinghouse Electric Corp., Huntsville, Ala.
PHOTOTRANSISTOR Patent
David H. McCann, inventor (to NASA) Issued 30 Jan. 1973 5 p Filed 19 Feb. 1971 Supersedes N72-11229 (10 - 02, p 0178) Sponsored by NASA
(NASA-Case-MFS-20407; US-Patent-3,714,526; US-Patent-Appl-SN-116777; US-Patent-Class-317-235R; US-Patent-Class-317-235N; US-Patent-Class-317-235AM; US-Patent-Class-317-235UA; US-Patent-Class-317-235T) Avail: US Patent Office CSCL 09A

A phototransistor is described in which there is included as a part of its integral structure an auxiliary diode in the form of an added base-collector junction. This junction is formed in the surface of the base element and thus out of the direct path between the emitter and collector regions of the phototransistor.
Official Gazette of the U.S. Patent Office

N73-19236 Auburn Univ., Ala.
ANTENNA ARRAY ANALYSIS OF ARBITRARILY-LOCATED, PARALLEL, CENTER-FED DIPOLES WITH TERMINALS IN A COMMON PLANE Ph.D. Thesis
Oliver Charles Williams, Jr. 1972 237 p
Avail: Univ. Microfilms Order No. 72-23635

Analytical methods are used to treat this generalized array in such a way as to be applicable to many antenna arrays which cannot be handled by other commonly used techniques in antenna analysis. For this reason the theoretical analysis is a contribution due to its adaptability to otherwise prodigious antenna problems. In particular, an approximate solution for the current distribution is found by the application of the method of moments to the coupled set of Hallen integral equations for the array. The basis functions are sinusoidal and the weighting functions are selected as Dirac delta functions. Several different types of arrays are considered and the current distribution found using a four term basis expansion. Based on the calculated current, the admittances and the far-field radiation patterns are determined for the arrays. Computer programs were written for the formulation and are listed in an appendix. Dissert. Abstr.

N73-19237 Cornell Univ., Ithaca, N.Y.
CHARACTERISTICS OF SUBHARMONICALLY INJECTION LOCKED MICROWAVE IMPATT DIODE OSCILLATORS Ph.D. Thesis
Chih-Hsien Chien 1973 151 p
Avail: Univ. Microfilms Order No. 72-23651

An experimental study of subharmonically injection locked microwave IMPATT diode oscillators has been conducted with the intent of improving its frequency stability and noise characteristics. A theory has been formulated to explain the mechanism of subharmonic injection locking in nonlinear negative resistance oscillators. Both theoretical and experimental studies have shown that the locking mechanism in subharmonic injection locking is essentially the same as that for fundamental injection locking. The proper harmonic of the injected signal generated through the nonlinearity of the device in the former case plays the role of the injected fundamental signal in the latter case.
Dissert. Abstr.

N73-19238 Oklahoma Univ., Norman.
SPIRAL TOP LOADED ANTENNA: CHARACTERISTICS AND DESIGN Ph.D. Thesis
Hiro Ramchand Bhojwani 1972 94 p
Avail: Univ. Microfilms Order No. 72-23088

To facilitate comparison among different top loaded antenna, a figure of merit is defined. To evaluate the figure of merit and efficiency (or bandwidth) requires a knowledge of the slope of reactance-frequency plot at resonance and the spatial current distribution on the antenna. To determine the current distribution, the electromagnetic boundary value problem for the antenna is formulated in terms of the currents on the antenna under the following assumptions: (1) the antenna wire is a perfect conductor; (2) current on the antenna is only in the axial direction; (3) the ground is flat and perfectly conducting. To be able to solve the resulting integral equation numerically it must be converted to a set of simultaneous linear equations. This is done by assuming a polynomial current distribution on the monopole and the spiral and requiring that the integral equation be satisfied at specified points on the antenna. Dissert. Abstr.

N73-19239*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
COMPUTER SIMULATION OF SPACE STATION COMPUTER STEERED HIGH GAIN ANTENNA Final Report
S. W. Beach 30 Jan. 1973 178 p
(Contract NAS9-12075)
(NASA-CR-128749; GCS/3267/6211) Avail: NTIS HC $11.00 CSCL 09E

The mathematical modeling and programming of a complete simulation program for a space station computer-steered high gain antenna are described. The program provides for reading input data cards, numerically integrating up to 50 first order differential equations, and monitoring up to 48 variables on printed output and on plots. The program system consists of a high gain antenna, an antenna gimbal control system, an on board computer, and the environment in which all are to operate.
J.M.M.

N73-19240# Defence Research Establishment Valcartier (Quebec).
PRELIMINARY MEASUREMENTS IN A DOUBLE-DISCHARGE TEA AMPLIFIER
F. Rheault, A. K. LaFlamme, and R. Fortin Dec. 1972 17 p refs
(DREV Proj. 97-01-20)
(DREV-TN-2022/72) Avail: NTIS HC $3.00

The design of a TEA CO2 amplifier is described which uses electrode configuration similar to a double discharge electrode geometry. The range of gas mixtures and electrical excitations for stable operation of the discharge is presented diagrammatically. A method for measuring the pumping efficiency in that range is described and use is made of this method for determining the optimum conditions of operation. Finally, the small signal gain is given for those particular optimum conditions. Author

N73-19241# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
A DIFFERENTIAL SYSTEM FOR MAGNETIC PROBE MEASUREMENTS
D. W. Ignat and A. Heym Aug. 1972 25 p refs
(LRP-55/72) Avail: NTIS HC $3.25

An integrated circuit differential amplifier and passive RC integration which provides magnetic probe signals of large bandwidth untroubled by electric pickup is described. Author

N73-19242# Sandia Labs., Albuquerque, N.Mex.
COMPTON DIODES: THEORY AND DEVELOPMENT FOR RADIATION DETECTORS
T. R. Fewell Oct. 1972 44 p refs Sponsored by AEC
(SC-DR-72-0118) Avail: NTIS

The Compton diode is examined from an engineering aspect. A brief operational type discussion of the detector is presented; each component of the Compton diode is examined in both theory and experiment. Special emphasis is placed on designing a Compton diode which is very reliable but simple in construction. It is shown that one can design a detector whose signal is nearly equal to the number of electrons impinging upon the collector. At radiation levels and rates used in experiments, the detector is essentially insensitive to problems such as charge buildup in dielectric, electron backscattering and other factors. Some design hints are also given to solve problems which could occur at higher radiation levels. Author (NSA)

N73-19243# Sandia Labs., Albuquerque, N.Mex.
NUMERIC DEFINITION OF SATELLITE PRINTED WIRING BOARDS
G. R. Urish Aug. 1972 29 p
(SC-TM-72-0645) Avail: NTIS

There are two methods of producing the artwork required for the fabrication of the satellite printed wiring boards, taping is one way and digitizing the board for numeric definiton is the other. The manual taping method was found to be extremely time consuming, however, the requirements involved made digitizing of the boards difficult. The two methods of preparing the artwork are described along with the specific requirements and the solutions that resulted to provide a system for efficiently digitizing the satellite printed wiring boards. D.L.G.

N73-19244# Bendix Corp., Kansas City, Mo.
ELECTRICAL TERMINATIONS: WELDED, BRAZED, AND BONDED, FY72-1
D. E. Stittsworth Jul. 1972 59 p
(Contract AT(29-1)-613)
(BDX-613-544) Avail: NTIS

Continued development of welding process-control methods included completion of the opposed electrode, parallel gap, and percussive arc monitoring systems. Evaluation of a silver/phosphorus/copper alloy for welding flexible copper circuits revealed that good bond, strengths can be obtained consistently with that alloy. CDA194 and CDA725 copper alloy, lead frames were successfully welded to both nickel-clad and copper-clad printed circuit boards; however, weld-parameter control was less critical when using CDA194. Fifty to 100 microinches of nickel and a gold overplating of 100 to 150 microinches were the best ranges of plating thickness for use on the lead frames.
Author

N73-19245# Bendix Corp., Kansas City, Mo.
CABLE FABRICATION AND ENCAPSULATION PROCESS IMPROVEMENTS FY72-4 Quarterly Report
T. J. Husby Oct. 1972 32 p
(Contract AT(29-1)-613)
(BDX-613-740) Avail: NTIS

Processes and equipment necessary for production of cables with the terminating ends potted to connector shells are being evaluated to improve cable quality and reduce costs. The present requirement of not more than 0.25-inch (6.35 mm) encapsulant wicking away from the potted areas must be maintained to preserve cable flexibility. The continuing studies include encapsulation materials and processes, wire identification methods, soldering techniques, and miscellaneous support work necessary to attain the high-quality low cost goals. Author

N73-19246# Bendix Corp., Kansas City, Mo.
CABLE FABRICATION AND ENCAPSULATION PROCESS IMPROVEMENTS FY72-3 Quarterly Report

T. J. Husby Sep. 1972 38 p
(Contract AT(29-1)-613)
(BDX-613-687) Avail: NTIS

Improved wire stripping methods and wire identification techniques are being developed to improve the quality and integrity of multiconductor cable terminations. Initial results indicate that the Roto-Therm wire stripper is superior to the currently-used stripping method and that an improved cable verification device provides an in-process wire identification method that is more reliable and less time consuming than present methods. Processing areas such as encapsulant wicking, wire pretinning, and use of solder sleeves to terminate multiconductor cables to closely-spaced connector pins also are included in this effort to improve cable quality. Author

N73-19247# Danish Research Center for Applied Electronics, Hoersholm.

COMPUTER PROGRAMME FOR SHAPED REFLECTOR ANTENNA SYNTHESIS AND ANALYSIS

J. Wested, N. Horstock, and E. Andersen 25 Sep. 1972 58 p refs
(Contract ESTEC-1542-71-CG)
(Rept-53199; ESRO-CR(P)-120) Avail: NTIS HC $5.00

A computer program for the synthesis and analysis of a microwave reflector antenna is described. The synthesis program, based on the geometrical optics method, compiles the shape of an axisymmetrical reflector which has the desired secondary radiation pattern for a given primary radiation. ESRO

N73-19248# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abtel lung Bordelektronik.

CAPACITY AND APPLICATIONS OF SEMICONDUCTOR AMPLIFIERS FROM L- TO Ku-BAND [LEISTUNGSFAEHIGKEIT UND EINSATZMOEGLICHKEITEN VON HALBLEITER-ENDSTUFEN VON L-BAND BIS ZUM KU-BAND]

B. Schmidt 1973 36 p refs In GERMAN; ENGLISH summary
(DLR-MITT-73-06) Avail: NTIS HC $4.00; DFVLR, Porz, West Ger: 11,50 DM

A survey is presented of the state of the art of semiconductors for generation and amplification of microwaves in the range from 1 to 15 GHz. In addition to the use of transistors and varactors in the lower GHz ranges, the progress in development of gunn and impatt diodes may accelerate their use for applications in the X- and K-band. Author (ESRO)

N73-19249# Naval Research Lab., Washington, D.C.

THE ACTION OF DITHER IN DIGITAL MATCHED FILTERS Final Report

J. J. Freeman 5 Dec. 1972 26 p refs
(NRL Proj. R01-45.301; WF15222602)
(AD-753808; NRL-7475) Avail: NTIS CSCL 09/4

An analysis has been made of how dither, a large suitably fluctuating component added to the input of a digital matched filter (digital correlator), eliminates capture of a weak signal by an unwanted signal. The signal-to-noise ratio of various correlators with two specific dithers in certain specific jamming environments was analyzed. The correlators analyzed, in comparison with a classical ideal correlator, were a polarity coincidence detector without dither, a polarity coincidence detector with dither of random amplitude uniformly distributed between the chosen plus-and-minus peak values, and a polarity coincidence detector with CW dither, each being analyzed for the cases of Gaussian noise, rectangular-pulse, and CW interference. The choice of dither amplitude based on the measured value of the noise power was studied. Author (GRA)

N73-19250# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Report, 15 May - 15 Aug. 1972

Walter F. Goede Nov. 1972 43 p
(Contract DAAB07-72-C-0076; DA Proj. 1S6-62705-A-005)
(AD-753604; NORT-72-280-2; ECOM-0076-2; QR-2) Avail: NTIS CSCL 09/1

The report describes the progress which occurred during the second quarter of a Research and Development contract to develop a 512 x 512 resolution-element display with a resolution of 55 holes per inch. This digitally addressed thin display tube is being developed to evaluate and demonstrate the feasibility of using this display concept to meet Army requirements for a computer output display. During the second quarter the substrate and electroding masks were ordered, a preliminary cathode-design was tested, an envelope configuration was selected and ordered, the logic and interface design was completed, including ordering of all parts, and the high-voltage switches and modulator design was completed. In addition, the first 160 x 256 resolution-element device at 55 holes per inch was fabricated and tested. Author (GRA)

N73-19251# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A COMPARATIVE INVESTIGATION OF THE VOLT-AMPERE CHARACTERISTICS OF EXPLOSIVE WIRES

P. M. Kolesnikov, V. A. Korotkov, and G. A. Nestetailov 29 Nov. 1972 13 p ref Transl. into ENGLISH from the book "Vopr. Fiz. Nizkotemperaturnoi Plazmy" Minsk, 1970 p 209-213
(AD-753552; FTD-HT-23-1287-72) Avail: NTIS CSCL 19/1

The experimental setup for the investigation of the volt-ampere characteristics of wire explosions consisted of a pulsed - current generator and a system for recording voltage on the wire and current in the discharge curcuit. The recording was carried out simultaneously with two OK-17M oscillographs. One of these was used to obtain time dependences U(t) and I(t). The second oscillograph recorded the v - ac of the electrical explosion of a wire; the horizontal-scanning generator in this case was switched off and the signal from the divider was supplied to the horizontal plates. Copper, chrome, aluminum and nickel wires were used. Author (GRA)

N73-19252# Magnavox Co., Fort Wayne, Ind. Governmental and Industrial Div.

COHERENT FREQUENCY SYNTHESIZER TECHNIQUES STUDY Technical Report, May 1971 - Jul. 1972

Albert G. Burke, III and Bill J. Hunsinger Griffiss AFB, N. Y. RADC Oct. 1972 72 p
(Contract F30602-71-C-0197)
(AD-753399; ASW-625; RADC-TR-72-273) Avail: NTIS CSCL 09/5

The report describes the design and operating characteristics of a pair of coherent frequency-hopped/pseudo-noise frequency synthesizers that produce a coherent 40 MHz bandwidth pseudo-noise waveform and which employ acoustic surface wave tapped delay lines as the signal-generating devices. A brief description is presented of the reason for the surface wave device implementation of the synthesizers. This presentation is followed by a detailed description of the synthesizer design. Then, a discussion follows of synthesizer testing and the results obtained. This testing revealed an RMS phase coherency between synthesizers within 0.31 radians of a perfect phase coherency, significantly better than the one radian RMS goal that had been set at the beginning of the project. Author (GRA)

N73-19253# IIT Research Inst., Annapolis, Md. Reliability Analysis Center.

MICROCIRCUIT GENERIC ENVIRONMENTAL DATA

Irvin L. Krulac Oct. 1972 147 p
(Contract F30602-72-C-0183; IITRI Proj. E6221)
(AD-753256; RAC-MGED-1072) Avail: NTIS CSCL 09/5

The compendium contains environmental test and screen/burnin results on microelectronic devices. Data are organized according to applied test stress and device generic properties. Aside from a description of the device and stress conditions, each data entry reports the number of devices tested, number failed and observed failure modes. A total of 2360 data entries are contained in this issue of which 2218 are environmental test results and the remaining are 142 screen/burnin results. The compendium is revised and reissued annually. Author (GRA)

N73-19254# Air Force Academy, Colo.

ROCK-CABLE, A COMPUTER PROGRAM TO SIMULATE AIRCRAFT TO MISSILE CABLE DYNAMICS

Terry D. Hinnerichs and Steven A. Crist Oct. 1972 43 p refs
(AD-753907; USAFA-RR-72-4) Avail: NTIS

The report describes the development of a FORTRAN

computer program that simulates the response, i.e., cable velocities and position vs. time of a cable being deployed from a missile as it flies out and away from the aircraft that the cable is attached to. The main objective of this program is to point out what conditions might allow the cable to wrap around the aircraft as the missile is deploying cable. The program is quite general in that any flightpath for the aircraft or missile can be directly employed into their respective subroutines and the state of the entire cable is then calculated as a function of time. The longitudinal shapes of the cable between the aircraft and missile have been plotted for two missile flightpaths and for various tensions imposed on the cable by the missile as it deploys the cable. Author (GRA)

N73-19255# Air Force Academy, Colo.
DYNAMICS OF CABLES TOWED FROM AIRCRAFT
James G. R. Hansen and Steven A. Crist Oct. 1972 94 p refs
(AD-753909; USAFA-RR-72-8) Avail: NTIS CSCL 09/5

The report describes a lumped mass computer simulation of a trailing wire system towed by an orbiting aircraft. The USAF U-10 aircraft flight conditions were used as applied to three flightpaths: constant altitude circular, constant altitude elliptical, and non-constant altitude circular orbit. These flightpaths were flown in no wind and 30 knot wind conditions. Wire lengths of 4000 ft and 8000 ft were used where the free end was attached to a circular sphere of 25 and 100 lbs. The results from 12 orbiting trailing wire configurations are tabulated and/or plotted. One of the main objectives in this analysis was to determine how yo-yo of the free end of the wire in wind might be alleviated or at least minimized. Author (GRA)

N73-19256# Air Force Academy, Colo.
STEADY STATE SHAPE OF ORBITING TRAILING WIRE SYSTEM
Terry D. Hinnerichs and Steven A. Crist Oct. 1972 37 p refs
(AD-753908; USAFA-RR-72-7) Avail: NTIS CSCL 09/5

The computer program described in this report simulates the spiral curve of a wire being towed behind an orbiting aircraft after steady state conditions have developed. Taking the case of a wire and drogue device towed by an aircraft in a constant orbit at a constant altitude, the authors divided the wire into n segments. Then each segment was treated as being in static equilibrium. Starting at the drogue end where all forces are known, general equations were derived which could be applied to each cable segment proceeding up to the aircraft. These equations were then programmed in FORTRAN 4 language. The results of this program's simulation of a USAF T-29 towing a wire are shown. Author (GRA)

N73-19257# General Electric Co., Schenectady, N.Y.
DESIGN, FABRICATION, AND EVALUATION OF AN ELECTRON BEAM ADDRESSABLE HIGH INFORMATION DENSITY MEMORY TUBE Quarterly Progress Report, 1 Jun. - 31 Aug. 1972
Charles Q. Lemmond Dec. 1972 36 p
(Contract DAAB07-72-C-0098; DA Proj. 1H6-31024-D-252)
(AD-753929; SRD-73-004; ECOM-0098-2; QPR-2) Avail: NTIS CSCL 09/2

During the second quarter, components for the first BEAMOS tube were completed and are ready for assembly. An assembly facility for BEAMOS tubes was established and all equipments are in place. Testing facilities for BEAMOS tubes are very nearly all complete. Studies of target physics continue. Author (GRA)

N73-19258# E-Systems, Inc., Falls Church, Va. Melpar Div.
DIELECTRIC LENS MODEL Final Technical Report
Philip L. Bachman Griffiss AFB, N. Y. RADC Nov. 1972 132 p refs
(Contract F30602-71-C-0129)
(AD-753914; Rept-1057.00100; RADC-TR-72-299) Avail: NTIS CSCL 09/5

A study was conducted to determine the design and measure the performance of phase-corrected horn antennas employing the dielectric lenses. The objective is to provide data for a dielectric lens antenna system to be evaluated in a satellite communications link. The frequency range of interest is from 15 to 60 GHz with maximum interest from 20 to 30 GHz. Computer programs were used to design lenses having two refracting surfaces and uniform amplitude distributions across the apertures for linked styrene for the lens material. Their performance was measured both individually and in array combinations, and the performance of larger arrays was predicted. Author (GRA)

N73-19980* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
GENERATION OF NARROW HIGH CURRENT PULSES
V. J. Menichelli and L. A. Rosenthal *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 38-43 (For availability see N73-19975 10-34)
CSCL 09C

N73-19034 Union Carbide Corp., Tarrytown, N.Y. Linde Div.
HIGH FIELD PLASMA ARC-PLATED Nb3Sn SUPERCONDUCTING SOLENOIDS
R. Allan Reese *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 8 p refs (For availability see N73-19030 10-03)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-19259 Virginia Polytechnic Inst. and State Univ., Blacksburg.
FOLLOWING THEORY WITH APPLICATIONS Ph.D. Thesis
Wilbert Edward Wilhelm 1972 203 p
Avail: Univ. Microfilms Order No. 72-24462

The concept of following was established and shown to explain a number of phenomena. A theory was provided which describes such processes as feedback controls, Markov processes, and the flow of automobiles and aircraft. Two types of stochastic following situations were considered. One demonstrated a mode of following in which entities influence each other through mutually repelling forces. The other exemplified the affect of acceleration noise in a mode of following associated with rectilinear motion. Mathematical analogies among queueing processes, car following models, and feedback controls were established. A derivation of the transient and steady state solutions to an alternating renewal process resulted from these analogies. Dissert. Abstr.

N73-19260*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
SYNTHESIS OF A NON-LINEAR FEEDBACK SYSTEM WITH SIGNIFICANT PLANT-IGNORANCE FOR PRESCRIBED TIME-DOMAIN TOLERANCES
K. R. Krishnan and I. M. Horowitz 12 Feb. 1973 107 p refs
(Grants NGR-06-003-083)
(NASA-CR-127489) Avail: NTIS HC $7.50 CSCL 09C

The problem considered is the design of a feedback system containing a linear, time invariant, minimum phase plant, whose parameters are known only within given bounds, such that the time response of the system remains within specified limits. A quasi-optimal design, for given design constraints, is one which minimizes the effect of white sensor noise on the input to the plant. An investigation was conducted on the use of the non linear device known as the Clegg integrator in the design of such a system. The describing function of the Clegg integrator has the same magnitude characteristic, apart from a scale factor, as the linear integrator, but has 52 deg less phase-lag, at all frequencies, than the linear integrator; thus, when used in a feedback system, it provides a larger stability margin than the linear integrator. This property allows the nonlinear feedback system to be designed so that the sensor noise is attenuated more than in the linear design. Author

N73-19261# Australian Post Office Research Labs., Melbourne.
COUPLED MICROSTRIP LINES AND DIRECTIONAL COUPLERS
L. A. Denger Mar. 1972 36 p refs
(Rept-6731) Avail: NTIS HC $4.00 CSCL 09C

An investigation is made to find a simplified method for

calculating the characteristics of coupled microstrip lines and directional couplers. That method is then applied to the design of a parallel microstrip line directional coupler and the results are compared with published data. Methods existing at the beginning of the present work were difficult to program for computer processing and were very time consuming. The present method permits the calculation of some of these characteristics with an accuracy better than 5% without computational difficulty and in a very short time. Author

N73-19262*# Aerojet Electrosystems Co., Azusa, Calif.
LWS DESIGN REPLACEMENT STUDY: OPTIMUM DESIGN AND TRADEOFF ANALYSIS Final Report
23 Feb. 1973 64 p
(Contract NAS9-13189)
(NASA-CR-128743; Rept-4713) Avail: NTIS HC $5.25 CSCL 09C

A design for two long-wavelength (LW) focal-plane and cooler assemblies, including associated preamplifiers and post-amplifiers is presented. The focal-planes and associated electronic assemblies are intended as direct replacement hardware to be installed into the existing 24-channel multispectral scanner used with the NASA Earth Observations Aircraft Program. An organization skilled in the art of LWIR systems can fabricate and deliver the two long-wavelength focal-plane assemblies described in this report when provided with the data and drawings developed during the performance of this contract. The concepts developed during the study including the alternative approaches and selection of components are discussed. Modifications to the preliminary design as reported in a preliminary design review meeting have also been included. Author

N73-19263# Danish Atomic Energy Commission, Risoe. Research Establishment.
[DEVELOPMENT OF INSTRUMENTATION FOR RISOE EXPERIMENTS, RESEARCH IN SYSTEM TECHNIQUES AND NUCLEAR GEOPHYSICAL METHODS, AND WORK IN THE SERVICE AREA] Semiannual Report, 1 Oct. 1971 - 31 Mar. 1972
Jul. 1972 27 p refs
(RISO-M-1509) Avail: AEC Depository Libraries

A review is given of the development of instrumentation for Riso experiments, research in system techniques and nuclear geophysical methods, and work in the service area. Publications issued during the half-year period are listed. Author (NSA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-19264# Aeronautical Research Labs., Melbourne (Australia).
AN INVESTIGATION OF STARTING PROBLEMS IN A SPECIALISED WIND TUNNEL FOR TESTING A RECTANGULAR MIXED COMPRESSION INTAKE AT MACH 3
S. A. Fisher and D. J. Ford Jun. 1972 70 p refs
(ARL/ME-138) Avail: NTIS HC $5.50

An open jet wind tunnel employing spill diffusion was designed to generate Mach 3 flow for testing a model of a variable ramp air intake with mixed supersonic compression. A detailed investigation of the complex behaviour observed, and an examination of the processes generally involved in starting supersonic wind tunnels were conducted. Unstarted flow in the diffuser assumed one of two distinct forms, depending on which side of the asymmetrical nozzle was favoured by the separated flow. Efforts to establish the design flow from one of these operating modes were unsuccessful, apparently because of choked flow in the intake model contraction. After a period of tunnel development, notably in the area of working section bleed, it was found possible to start the tunnel with the flow in the other mode. The developed tunnel had good handling qualities, displaying little sensitivity to the intake model geometry and operating well within the capacity of the available air supply. Author

N73-19265# Aeronautical Research Labs., Melbourne (Australia).
A SHORT DIFFUSER WITH FLOW TURNING
T. S. Keeble and W. H. Schofield Jun. 1972 14 p
(ARL/ME-334) Avail: NTIS HC $3.00

A 48 in diameter simple baffle combustor was constructed to provide heated air to several test facilities. The ducting between the fan and combustion chamber was found to be unsatisfactory in that the mean flow distribution entering the combustion chamber was badly distorted and had a large region of reversed flow. This distortion was attributed to two factors, a poor diffuser design and secondly the initial distorted inlet flow from the centrifugal fan. A new diffusing section was required to fit between the existing positions of fan and combustion chamber which would give an even distribution to flow entering the combustion zone. Author

N73-19266# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: AIRPORT PAVEMENT
Oct. 1972 42 p
(FAA-ED-08-2) Avail: NTIS HC $4.25

A research program for upgrading airport pavement technology by a coordinated contractor/in-house/industry effort is presented. Data cover: (1) design guidance and criteria using current methodology to meet current and future pavement load requirements with available materials, at reasonable cost with adequate life span, (2) pavement material and construction standards to insure that design criteria are realized, (3) test methods and standards for evaluating performance of new pavement and predicting the life span of existing pavements, (4) methods for improving, repairing, and rehabilitating existing pavement and surfaces to improve effectiveness and extend service life, and (5) rational pavement structural design criteria procedures based upon a mathematical model capable of simulating pavement load response. Author

N73-19267*# California Univ., Los Angeles. Molecular-Beam Lab.
MOLECULAR-BEAM GAS-SAMPLING SYSTEM Final Report
W. S. Young and E. L. Knuth Dec. 1972 40 p refs
(Contract JPL-953161)
(NASA-CR-130933) Avail: NTIS HC $4.00 CSCL 14B

A molecular beam mass spectrometer system for rocket motor combustion chamber sampling is described. The history of the sampling system is reviewed. The problems associated with rocket motor combustion chamber sampling are reported. Several design equations are presented. The results of the experiments include the effects of cooling water flow rates, the optimum separation gap between the end plate and sampling nozzle, and preliminary data on compositions in a rocket motor combustion chamber. Author

N73-19268*# TRW Systems Group, Redondo Beach, Calif.
DEFINITION OF EXPERIMENTS AND INSTRUMENTS FOR A COMMUNICATION/NAVIGATION RESEARCH LABORATORY. VOLUME 4: PROGRAMMATICS
Oct. 1972 103 p refs 4 Vol.
(Contract NAS8-27540)
(NASA-CR-124139; TRW-20405-6001-R0-81-Vol-4) Avail: NTIS HC $7.25 CSCL 14B

Details are provided for scheduling, cost estimates, and support research and technology requirements for a space shuttle supported manned research laboratory to conduct selected communication and navigation experiments. A summary of the candidate program and its time phasing is included, as well as photographs of the 1/20 scale model of the shuttle supported Early Comm/Nav Research Lab showing the baseline, in-bay arrangement and the out-of-bay configuration. J.M.M.

N73-19269*# Washington Univ., Seattle.
WIND TUNNEL INTERFERENCE FACTORS FOR HIGH-LIFT WINGS IN CLOSED WIND TUNNELS Ph.D. Thesis - Princeton Univ.

Robert G. Joppa Washington NASA Feb. 1973 126 p refs (Grant NGL-48-002-010)
(NASA-CR-2191) Avail: NTIS HC $3.00 CSCL 14B

A problem associated with the wind tunnel testing of very slow flying aircraft is the correction of observed pitching moments to free air conditions. The most significant effects of such corrections are to be found at moderate downwash angles typical of the landing approach. The wind tunnel walls induce interference velocities at the tail different from those induced at the wing, and these induced velocities also alter the trajectory of the trailing vortex system. The relocated vortex system induces different velocities at the tail from those experienced in free air. The effect of the relocated vortex and the walls is to cause important changes in the measured pitching moments in the wind tunnel. Author

N73-19270# Grenoble Univ. (France). Inst. des Sciences Nucleaires.
STATUS REPORT ON AXIAL INJECTION IN THE GRENOBLE CYCLOTRON
J. L. Belmont, J. M. Bois, and J. Ferme 1972 6 p refs Presented at 6th Intern. Cyclotron Conf., Vancouver, B. C., 18-21 Jul. 1972
(FRNC-CONF-59; Conf-720717-8) Avail: AEC Depository Libraries

The channel, electrostatic deflector, buncher, and pulser of the Grenoble cyclotron injection system for injection of multi-charged heavy ions are described. NSA

N73-19271# Brookhaven National Lab., Upton, N.Y.
VISUAL DETECTORS FOR ISA
B. Roe (Michigan Univ.) and H. French (Michigan Univ.) 12 Oct. 1972 5 p Sponsored by AEC
(BNL-17273; CRISP-72-83) Avail: NTIS

A proposal for an experimental facility for ISABELLE employing visual radiation detectors for studying high energy interactions is briefly described. It is proposed that the initial design of ISABELLE include an intersection region immersed in a large volume magnetic field in which the visual detectors can be placed. NSA

N73-19272# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
METHOD OF CALCULATING THE SUSTAINING FORCE OF A MAGNETIC SUSPENSION FOR AN ULTRACENTRIFUGE
M. Donnetti, F. Moscati, and G. M. Veca 22 May 1972 20 p In ITALIAN
(LNF-72/49) Avail: AEC Depository Libraries

A calculation method is proposed for the determination of the map of the magnetic field for a given geometry where the conducting slab is moving in the direction of the axis with the velocity. There are two external slabs of very high permeability so that at the interior the field from the permanent magnets can be considered zero. Author (NSA)

N73-19273# Sulzer Bros., Ltd., Winterthur (Switzerland). Dept. for Chemical and General Plant Engineering.
FEASIBILITY STUDY FOR A THERMAL-MECHANICAL FATIQUE TEST PLANT FOR THE SPACE SHUTTLE Final Report
Apr. 1972 168 p refs
(Contract ELDO-CTR-17/8/3)
Avail: NTIS HC $10.50

The feasibility of a thermal-mechanical fatigue test plant for the space shuttle orbiter vehicle is investigated. During a test cycle time of six hours, the test vehicle would be subjected to simulated service conditions which occur during the exit-orbit-entry and cruise back sequences. Thermal and mechanical loads would be applied to the structure both internally and externally. The number of complete test cycles would be about 200, or double the expected life of the orbiter; it is expected that this number of cycles would be completed in 18 to 20 months. Energy requirements for the thermal loads were computed for the whole vehicle and integrated over the whole test cycle to give total energy. External heating is done by a combination of direct and indirectly heated radiating surfaces, using propane gas as a source of energy. External cooling is done by conventional convective methods. Internal cooling and conditioning with a closed circuit system. The whole test cycle is controlled from a central program unit with the capacity for retrospective correction to programmed values. ESRO

N73-19274# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
OPERATIONAL ASPECTS OF THE INTEGRATED CHECK-OUT SYSTEM FOR EUROPA 3
[1972] 107 p refs Prepared for Arbeitsgemeinschaft Satellit Entraeger-System (ASAT) Sponsored by ELDO
Avail: NTIS HC $7.50

The Europa 3 launch vehicle checkout system layout is discussed. Comments and suggestions based on experience gained during development of other checkout systems (Europa 1 and 2, third stage) are presented. The critical areas are identified, and several aspects and solutions are considered. ESRO

N73-19275# Aerospace Corp., El Segundo, Calif. Lab. Operations.
VHF TO EHF PERFORMANCE OF A 90 FOOT QUASI-TAPERED ANECHOIC CHAMBER, JULY 1970 - JULY 1972
Robert B. Dybdal and Cleyon O. Yowell 28 Dec. 1972 26 p refs
(Contract F04701-72-C-0073)
(AD-754203; TR-0073(3230-40)-2; SAMSO-TR-72-300) Avail: NTIS CSCL 14/2

The measured reflection characteristics of a 90-ft anechoic chamber operated by The Aerospace Corporation are reported. The design of this chamber, described as quasi-tapered, is unique in that it tapers from a large rectangular test region to a smaller square transmitting end. This design incorporates the performance advantages of a fully tapered chamber at low frequencies with some of the flexibility of a rectangular chamber when used at higher frequencies. The performance of this chamber is reported from 100 MHz to 93 GHz. Author (GRA)

N73-19276# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION OF XM20 AND XM20E1 LANDING MATS UNDER HEAVY-DUTY LOAD Final Report
Carroll J. Smith Dec. 1972 71 p refs
(DA Proj. 1G6-64717-D-Hd1)
(AD-753935; AEWES-Misc-Paper-S-72-39) Avail: NTIS CSCL 01/5

The report describes investigations conducted to evaluate two aluminum alloy landing mats. These mats were designated as XM20 and XM20E1, and they are one-piece hollow extrusions fabricated from 6061 aluminum alloy artificially aged to the T6 condition. Investigations consisted of traffic, skid, and laboratory tests to obtain information for use in evaluating the mats for potential use as heavy-duty landing mats. Traffic tests were conducted with the mats placed on a prepared subgrade and trafficked with a rolling wheel load simulating actual aircraft operations. Author (GRA)

N73-19624 Arbeitsgemeinschaft Deutscher Verkehrsflughaefen, Stuttgart (West Germany).
THE TRAFFIC LANDING FIELDS TODAY [DIE VERKEHR-SLANDEPLAETZE HEUTE]
Kurt Siebenwurst *In* DGLR Report on the DGLR-Symp. on Air Traffic Operation Dec. 1972 p 7-14 In GERMAN (For availability see N73-19623 10-21)

N73-19625 Arbeitsgemeinschaft Deutscher Verkehrsflughaefen, Stuttgart (West Germany).
AIRPORTS TODAY: SIGNIFICANCE AND PROBLEMS OF AIRPORTS IN TODAYS AIR TRAFFIC [FLUGHAEFEN HEUTE BEDEUTUNG UND PROBLEME DER FLUGHAEFEN IM HEUTIGEN LUFTVERKEHR]
Udo Wolffram *In* DGLR Report on the DGLR-Symp. on Air Traffic Operation Dec. 1972 p 15-24 In GERMAN (For availability see N73-19623 10-21)

N73-19057 Pisa Univ. (Italy). Facolta di Ingegneria.
THEORETICAL MODELS FOR PLASMA MOTION IN PULSED COAXIAL HYDROMAGNETIC GUNS
M. Andrenucci, M. Caprili, and R. Lazzeretti *In* AGARD Energetics

for Aircraft Auxiliary Power Systems Feb. 1972 17 p refs (For availability see N73-19030 10-03)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-19277 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A FINITE DIFFERENCE METHOD FOR PREDICTING SUPERSONIC TURBULENT BOUNDARY LAYER FLOWS WITH TANGENTIAL SLOT INJECTION Ph.D. Thesis
Earnest Wade Miner 1972 124 p
Avail: Univ. Microfilms Order No. 72-24454

An implicit finite-difference method has been developed for the solution of the compressible boundary-layer equations. This method is applied to tangential slot injection into supersonic turbulent boundary-layer flows. In addition, the effects induced by the interaction between the boundary-layer displacement thickness and the external pressure field are considered. Three different eddy viscosity models have been used to specify the turbulent momentum exchange. Calculations were made with the present method and results were compared with experimental data and with results of another finite-difference method. Good agreement was obtained for the reduction of wall skin friction with slot injection. Comparison with available experimental Mach number and pitot pressure profiles gave reasonable agreement in most cases. Dissert. Abstr.

N73-19278 Houston Univ., Tex.
SECOND SOUND IN COUNTERFLOWING NORMAL AND SUPERFLUID HELIUM 2 Ph.D. Thesis
Earl Mead Johnson 1971 86 p
Avail: Univ. Microfilms Order No. 72-23831

From ordinary hydrodynamics it is known that an entrainment of sound occurs in a moving fluid. A similar effect is expected to take place in the hydrodynamics of Helium II. A measurement has been made of the change in the time of flight of a second sound pulse as a function of the relative velocity (v sub n minus v sub s), where v sub n is the normal fluid velocity and v sub s is the superfluid velocity. A temperature range of 2.10 K through 1.00 K was covered. A typical time of flight at 1.75 K for a second sound pulse for stationary conditions was 5.8622 milliseconds. The change in the time of flight for a normal fluid velocity of 0.4 cm/sec at 1.75 K was 0.7 microseconds. Each time of flight for the second sound pulses was measured within plus or minus 0.1 microseconds. Dissert. Abstr.

N73-19279 Kansas State Univ., Manhattan.
EXPERIMENTAL INVESTIGATION OF EDDY DIFFUSIVITIES OF AIR IN TURBULENT ANNULAR FLOW Ph.D. Thesis
Herbert Dean Ball 1972 268 p
Avail: Univ. Microfilms Order No. 72-19761

The ratio of eddy diffusivity of heat to the eddy diffusivity of momentum for heating of air in turbulent annular flow and to investigate the effect of various flow parameters on the eddy diffusivities ratio was determined. The tests were conducted with air flowing in a 32-foot long annular flow channel formed of a 2-inch diameter inner pipe located concentrically within an 8-inch diameter outer pipe. The inner pipe was heated by passing an electric current through it, starting 20 feet from the entrance and terminating 2 feet from the exit. Thus, the first 20 feet (40 equivalent diameters) served as an isothermal dampening section. Velocity and temperature profiles, together with heat transfer and pressure loss, were measured at stations located 10.6 and 14.4 equivalent diameters downstream of the beginning of the heated section. Dissert. Abstr.

N73-19280 California Univ., San Diego.
AN EXPERIMENTAL STUDY OF GASDYNAMICAL TURBULENCE Ph.D. Thesis
Shih-Chun Lin 1972 230 p
Avail: Univ. Microfilms Order No. 72-24634

A nearly homogeneous grid turbulence field with large-amplitude temperature fluctuations is investigated experimentally. In order to generate a nearly homogeneous flow field with large temperature fluctuations in the laboratory, a 21' x 21' variable density, subsonic wind tunnel with the capability of generating Reynolds number per inch up to 3.5 x 10,000 through the use of a direct liquid nitrogen spraying system, has been designed and developed. The details of the design and the discussion of the tunnel performances are presented. A nearly homogeneous turbulence field with large amplitude temperature fluctuations is generated in the 21' x 21' test section by rapid mixing of 64 hot and cold air streams behind a specially constructed grid. Electrical heating power up to 300 kW is applied to generate initial hot and cold stream temperature ratios up to 1.6 at a mean velocity of about 11 m/sec. Dissert. Abstr.

N73-19281*# Alabama Univ., Huntsville. Dept. of Fluid and Thermal Engineering.
ANALYTICAL TREATMENT OF GAS FLOWS THROUGH MULTILAYER INSULATION, PROJECT 1 Final Report
J. T. Lin [1972] 24 p refs Sponsored by NASA
(NASA-CR-124130) Avail: NTIS HC $3.25 CSCL 20D

A theoretical investigation of gas flow inside a multilayer insulation system was made for the case of the broadside pumping process. A set of simultaneous first-order differential equations for the temperature and pressure of the gas molecules through the perforations on the insulation layers. A modified Runge-Kutta method was used for numerical experiment. The numerical stability problem was also investigated. It was shown that when the relaxation time is less than the time period over which the gas properties change appreciably, the set of differential equations can be replaced by a set of algebraic equations for solution. Numerical examples were given and comparisons with experimental data were made. Author

N73-19282*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
NUMERICAL CALCULATIONS OF FLOW FIELDS Final Report
D. Anderson and J. Vogel Jan. 1973 5 p refs
(Grant NGR-16-002-029; Proj. 911-S)
(NASA-CR-131089; ISU-ERI-AMES-73005) Avail: NTIS HC $3.00 CSCL 20D

Numerical calculations were made of flow fields generated by various aerodynamic configurations. Data cover flow fields generated by a finitely thick lifting three dimensional wing with subsonic tips moving at supersonic speeds, cross flow instability associated with lifting delta wing configurations such as space shuttles, and flow fields produced by a lifting elliptic cone. Finite difference techniques were used to determine elliptic cone flow. Author

N73-19283# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
REPORT ON THE THIRD MEETING OF THE DGLR-SCIENTIFIC COMMITTEE ON FLOW MECHANICS TEST TECHNIQUE: STATIONARY AND NONSTATIONARY PRESSURE TESTS AND FLUTTER TESTS
A. Heyser and B. Ewald Oct. 1972 178 p refs In GERMAN; ENGLISH summary Meeting held at Munich, 29 Feb. 1972
(DLR-Mitt-72-25) Avail: NTIS HC $11.00; ZLDI Munich: 39.70 DM

Stationary and nonstationary pressure tests and flutter tests conducted in wind tunnels are discussed. The characteristics of probes for pressure and direction measurement in different speed ranges for stationary and nonstationary flow are described. Wind tunnel corrections during pressure tests are explained. The performance of flutter tests and the construction of aeroelastic models for these tests are reported. For individual titles, see N73-19284 through N73-19291.

N73-19284 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
COMPARATIVE MEASUREMENTS WITH A DANBERG TEMPERATURE PROBE AND A COMBINATION PRESSURE TEMPERATURE PROBE IN TURBULENT BOUNDARY LAYERS OF SUPERSONIC FLOW [VERGELEICHSMESSUNGEN MIT EINER DANBERG-TEMPERATUR-SONDE UND EINER KOMBINIERTEN DRUCK-TEMPERATUR-

SONDE IN TURBULENTEN GRENZSCHICHTEN BEI UEBERSCHALLSTROEMUNG]

H. U. Meier, R. E. Lee (NOL, White Oak, Md.), and R. L. Voisinet (NOL, White Oak, Md.) *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 7-11 In GERMAN; ENGLISH summary (For availability see N73-19283 10-12)

The characteristics of total pressure and total temperature probes used for boundary layer investigations at supersonic speeds are presented. Two types of probes are compared under the same flow conditions. The total pressure and total temperature distributions in turbulent boundary layers developed at the flat nozzle wall of a boundary layer wind tunnel were the measured parameters. Cases of flow with and without heat transfer from the boundary layer to the wall are considered. In the region of constant Mach number, the pressure gradient in the flow direction is equal to zero. Author

N73-19285 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

A WEDGE PROBE FOR THREE DIMENSIONAL WAKE FLOW MEASUREMENTS IN THE SUBSONIC AND TRANSONIC VELOCITY REGIME

O. Lawaczeck *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 13-40 refs In GERMAN; ENGLISH summary (For availability see N73-19283 10-12)

A wedge probe for three dimensional wake flow measurements in subsonic and transonic flow fields is described. The wedge is machined from high tensile steel to prevent damage from small dust and dirt particles in the flow. The probe was calibrated in a transonic wind tunnel and results of the calibration are presented. The probe is used in downstream flow measurements of the last stage of steam turbines where temperatures may reach 250 C. Author

N73-19286 Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).

FLUTTER MEASUREMENTS [FLATTERMESSUNGEN]

F. Waesche and A. Vasel *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 41-55 In GERMAN (For availability see N73-19283 10-12)

Techniques for wind tunnel measurements of the flutter characteristics of aerodynamic shapes are discussed. Requirements and limitations for the fabrication of wind tunnel models are explained. A method for suspending the model in the wind tunnel is described. Illustrations of model construction, the wind tunnel apparatus, and the test equipment used to record the data are included. Transl. by P.N.F.

N73-19287 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).

THE BLOCKAGE CORRECTIONS IN PRESSURE DISTRIBUTION MEASUREMENTS ON SUBSONIC WIND TUNNELS AND LIMITATIONS IN THEIR APPLICABILITY [DIE VERDRAENGUNGSKORREKTUREN BEI DRUCKVERTEILUNGSMESSUNGEN IN UNTERSCHALLWINDKANAELEN UND DIE GRENZEN IHRER ANWENDBARKEIT]

G. Schulz *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 57-86 refs In GERMAN (For availability see N73-19283 10-12)

The application of air flow blockage corrections for pressure measurement in subsonic wind tunnels is discussed. Mathematical models of flow equations are developed to show the relationship of the flow correction factors. Specific cases of flow disturbance are analyzed based on variations in interference parameters. Graphs of typical pressure distribution measurements are included. Transl. by P.N.F.

N73-19288 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

TURBULENT PRESSURE MEASUREMENTS ON ENGINE INLET FLOWS [MESSUNG VON DRUCKTURBULENZEN IN TRIEBWERKSEINLAEUFEN]

W. Habig *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 87-91 refs In GERMAN (For availability see N73-19283 10-12)

Total pressure measurements for the cross section of a supersonic diffuser inlet flow model show that: (1) time fluctuations in total pressure are usually distributed over a frequency region less than or equal to 1000 Hz with local variations in effective turbulence values; (2) time fluctuations for measured static flow pressure are about 10 times lower than total pressure when acoustic waves are absent. Static pressure fluctuations can reach up to 50% of total pressure under certain conditions; (3) time variations in flow density are proportional to measured static pressure fluctuations; and (4) acoustic wave and axial flow velocity variations in the turbulent field can be determined by correlating total pressure propagation time, static pressure, and flow density. Transl. by G.G.

N73-19289 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany).

ERROR SOURCES IN TURBULENT PRESSURE FLUCTUATION MEASUREMENTS WITH FLOW AROUND MICROPHONES [FEHLERQUELLEN BEI DER MESSUNG TURBULENTER DRUCKSCHWANKUNGEN MIT UMSTROEMTEN MIKROFONEN]

H. Fuchs *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 93-103 refs In GERMAN (For availability see N73-19283 10-12)

Nonstationary pressure measurements in turbulent flows by microphones are subject to resolution errors, echo noise, acoustic sensitivity changes, vibration sensitivity, flow circulation noise, and banking-up of vertical and horizontal velocities. Transl. by G.G.

N73-19290 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

EFFECTS OF PRESSURE ORIFICE INCLINATION ON MEASUREMENTS IN LOW DENSITY HYPERSONIC FLOW [UEBER DEN EINFLUSS EINER NEIGUNG DER DRUCKMESSBOHRUNG AUF DEN MESSWERT IN VERDUENNTER HYPERSCHALLSTROEMUNG]

K. Kienappel *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 105-158 refs In GERMAN (For availability see N73-19283 10-12)

Static hole error effects on pressure distribution in low density hypersonic flow field on flat plate surface are analyzed. It is shown that measured static pressure is a function of the angle formed by the bore hole with the surface. Angle effect is produced by the nonequilibrium in the flow field and increases within the vicinity of slender body frontal edge. The Patterson theory is sufficient to calculate inclination angle effects in small measurement errors. Transl. by G.G.

N73-19291 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

CONSTRUCTION METHODS FOR AEROELASTIC MODELS IN RATIONAL FLUTTER STUDIES [BAUWEISEN AEROELASTISCHER MODELLE FUER EINE RATIONELLE FLATTERUNTERSUCHUNG]

Heinz Hoenlinger *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 159-185 refs In GERMAN (For availability see N73-19283 10-12)

A combinatorial numerical-experimental flutter analysis method is reported for the development of airplanes with variable geometries. Designs of various aeroelastic flutter model geometries for wind tunnel simulations consider velocity limitations, oscillatory loads, and flexibility and stiffness matrices of beam network structures. Transl. by G.G.

N73-19292# National Physical Lab., Teddington (England). Div. of Maritime Science.

WIND TUNNEL MEASUREMENTS OF THE PRESSURE DISTRIBUTION ON A MODEL OF A FRIGATE MAINTENANCE BUILDING

R. W. F. Gould and W. G. Raymer May 1972 45 p refs (NPL-Mar-Sci-10-72) Avail: NTIS HC $4.25

Measurements were made in a compressed air wind tunnel of the time-average pressures on external and internal surface of a hangar-type model of a large building. The effect of opening large access doors and of varying the aperture of roof ventilator

outlet slots significantly reduced extreme suction pressure near the edges of the roof, as a result of flow changes around the ventilator inlet slots in the windward wall of the building. Effects of changing the wind gradient during tests were very slight.
Author

N73-19293# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
VELOCITY MEASUREMENTS IN BUBBLY TWO-PHASE FLOWS USING LASER DOPPLER ANEMOMETRY, PART 1
W. E. R. Davies Jan. 1973 17 p refs
(UTIAS-TN-184-Pt-1) Avail: NTIS HC $3.00

Optical instrumentation utilizing the laser Doppler method has been employed to measure the velocity of steam and water in a two-phase flow. The apparatus is relatively simple, not unduly sensitive to vibration and may be constructed to cover a large range of flow velocities.
Author

N73-19294# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON PRANDTL MIXING PATHS, CRITERIA AND SCALES OF TURBULENCE
E. M. Minskii and M. S. Fomichev [1972] 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (Moscow), no. 6, 1972 p 119-123
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The connection between the Prandtl mixing path, criteria characterizing the pressure and velocity pulsations, the longitudinal Euler scale, the time scale, and the Lagrange turbulence scale is analyzed for a developed uniform turbulent stream. The regular connection between the amplitude of the velocity pulsations and the amplitude of the dynamic pressure pulsations is clarified. A numerical value is obtained for the magnitude of the amplitudes of the velocity or pressure pulsations expressed in terms of the Euler or Karman criteria in the domains near the wall or near the base, as well as on the axis of the turbulent stream (in the case of flow in a smooth pipe) or on the surface (in the case of flow in an open channel with smooth bottom or walls).
Author

N73-19295*# Linguistic Systems, Inc., Cambridge, Mass.
THE INFLUENCE OF TEMPERATURE ON THE BURN-OUT OF A HYDROGEN DIFFUSION FLAME IN A SUPERSONIC FLOW IN A CLOSED CHANNEL
R. S. Tyulpanov and O. V. Pritsker Washington NASA Mar. 1973 13 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), no. 1, 1972 p 77-81
(Contract NASw-2482)
(NASA-TT-F-14844) Avail: NTIS HC $3.00 CSCL 20D

An investigation was made of the influence of temparature on the diffusion burning of a hydrogen flame in a closed channel with a supersonic flow. It was determined that the initial total temperature has a significant influence on the length of the flame and the nature of the ignition process.
Author

N73-19296# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
COMPUTER EXPERIMENTS ON CLASSICAL FLUIDS. 4: TRANSPORT PROPERTIES AND TIME CORRELATION FUNCTIONS OF THE LENNARD-JONES LIQUID NEAR ITS TRIPLE POINT
D. Levesque, L. Verlet, and Johanni Kurkijarvi (Helsinki Univ.) Jun. 1972 46 p refs
(LPTHE-72/22) Avail: NTIS HC $4.50

A molecular dynamics experiment was performed for a system of 864 particles interacting through a Lennard-Jones potential. The state considered was in the immediate neighborhood of the triple point. The total duration of the experiment was quite large: it corresponds to 10 to the -9th power sec in the case of Argon. Transport coefficients were calculated, using the standard Kubo formulae. They are compared with the prediction of a simple hard sphere model. It is shown that, as in the case of the hard sphere fluid near solidification, the Kubo correlation function relative to the shear viscosity presents a tail extending at large time. The inclusion of this tail turns out to be essential in explaining the transverse correlation function and the dynamical structure factor, which presents, for the lowest wave vectors accessible in this study, a characteristic Brillouin doublet structure. Using the hydrodynamical model of Zwanzig and Bixon, it is shown that the introduction of the long time tail in the Kubo current for viscosity explains the negative plateau of the velocity autocorrelation function observed, near the triple point by Rahman and others.
Author

N73-19297*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
UNSTEADY TURBULENT BOUNDARY LAYER ANALYSIS
R. E. Singleton (Lockheed-Georgia Co., Marietta), J. F. Nash (Lockheed-Georgia Co., Marietta), L. W. Carl (Army Air Mobility R and D Lab., Moffett Field, Calif.), and U. C. Patel (Inst. of Hydraulic Res.) Feb. 1973 69 p refs
(NASA-TM-X-62242) Avail: NTIS HC $5.50 CSCL 20D

The governing equations for an unsteady turbulent boundary layer on a swept infinite cylinder, composed of a continuity equation, a pair of momentum equations and a pair of turbulent energy equations which include upstream history efforts, are solved numerically. An explicit finite difference analog to the partial differential equations is formulated and developed into a computer program. Calculations were made for a variety of unsteady flows in both two and three dimensions but primarily for two dimensional flow fields in order to first understand some of the fundamental physical aspects of unsteady turbulent boundary layers. Oscillating free stream flows without pressure gradient, oscillating retarded free stream flows and monotonically time-varying flows have all been studied for a wide frequency range. It was found that to the lowest frequency considered, the lower frequency bound being determined by economic considerations (machine time), there were significant unsteady effects on the turbulent boundary layer.
Author

N73-19298*# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPRESSION OF HELIUM TO HIGH PRESSURES AND TEMPERATURES USING A BALLISTIC PISTON APPARATUS
B. P. Roman, G. P. Rovel, and M. J. Lewis Sep. 1971 29 p
(Grant NGR-05-013-021)
(NASA-CR-131230; VKI-Preprint-71-7) Avail: NTIS HC $3.50 CSCL 20D

Some preliminary experiments are described which were carried out in a high enthalpy laboratory to investigate the compression of helium, a typical shock-tube driver gas, to very high pressures and temperatures by means of a ballistic piston. The purpose of these measurements was to identify any problem areas in the compression process, to determine the importance of real gas effects during this process, and to establish the feasibility of using a ballistic piston apparatus to achieve temperatures in helium in excess of 10,000 K.
Author

N73-19299*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF THE PRINCIPLE OF CORRESPONDING STATES TO TWO PHASE CHOKED FLOW
Robert C. Hendricks and Robert J. Simoneau 1973 18 p refs Presented at 74th Natl. Meeting of the Am. Inst. of Chem. Engr., New Orleans, 11-15 Mar. 1973
(NASA-TM-X-68193; E-7340) Avail: NTIS HC $3.00 CSCL 20D

It is pointed out that several fluids including methane, oxygen, and nitrogen appear to form an average parametric plot which indicates that the isenthalpic Joule-Thomson coefficient must nearly obey the principle of corresponding states. With this as a basis, it was assumed that there could be several thermodynamic flow processes which nearly obey the principle. An examination was made to determine whether two-phase choked flow could be one of them. The analysis is described and the results are given.
D.L.G.

N73-19300# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
LOCAL MEASUREMENT AND THEIR STATISTICAL INTERPRETATION FOR A HIGH VELOCITY TWO-PHASE FLOW WITH HIGH VOID FRACTION
Henri Lecroat and Joseph Lewi [1972] 7 p refs In FRENCH; ENGLISH summary Presented at 12th Meeting on Hydraulics, Paris, 6 Jun. 1972
(CEA-CONF-2043; Conf-720648-21) Avail: AEC Depository

Libraries

Because of the size of the bubbles in a two-phase high-velocity flow, local measurements require very small temperature probes, which are used in conjunction with a feedback amplifier giving considerably improved time constants. A model for the emulsion is derived from the experimental results, which gives both the diameter distribution and the statistical laws governing the passage of the bubbles past a given point. The gas/liquid interface velocity is found by intercorrelation with a two-electrode probe. NSA

N73-19301# Paris Univ., Orsay (France).
PHYSICAL QUANTITIES IN TWO-PHASE FLOWS
M. Fitremann 1972 4 p refs In FRENCH; ENGLISH summary Presented at 12th Meeting on Hydraulics, Paris, 6 Jun. 1972
(FRNC-CONF-49; Conf-720648-17) Avail: AEC Depository Libraries

In two-phase flows, conservation equations involve variables that are averaged both over a cross section and statistically. Such variables are defined together with other quantities involved in two-phase flow equations, assuming that there is no thermal exchange between the two phases and the walls. NSA

N73-19302# Sandia Labs., Albuquerque, N.Mex.
FLOW FIELD, PRESSURE AND HEAT TRANSFER ASSOCIATED WITH SMALL FINS IN LAMINAR HYPERSONIC FLOW
T. T. Bramlette Nov. 1972 64 p refs
(Contract AT(29-1)-789)
(SCL-RR-720339) Avail: NTIS

The flow field structure (surface streamlines and shock patterns), pressure, and heat transfer distributions associated with small fins mounted near the base of a 7-degree half angle cone were measured. The tests were conducted in a hypersonic freestream at a Mach number of 10, freestream unit Reynolds numbers of 0.12 and 0.6 x 10 to the 6th power/foot, and wall to total temperature ratio of 0.27. Vehicle geometry (nose bluntness, and fin sweep, shape, thickness, and cant) and orientation (angles of attack and roll) were systematically varied. Experimental results are compared with theoretical predictions and/or earlier related experimental work. Where prediction techniques do exist, empirical correlations are suggested. Author

N73-19303# Bendix Corp., Kansas City, Mo.
FLUID FLOW ANALYSIS IN THE MOLD HEATING AND COOLING CONTROL LOOP Interim Report
R. H. Floersch Sep. 1972 101 p refs
(Contract AT(29-1)-613)
(BDX-613-742) Avail: NTIS

Fluid temperature control in the mold heating and cooling control loops is directly related to the magnitude of the fluid flow rate. A theoretical analysis of the fluid loop process gain, and how the loop flow rate effects the stability of the temperature loop, is presented. The heat transfer fluid flow rate in the control loop is dependent upon the mold channel design prior to mold fabrication would indicate impending temperature control problems. Methods for predicting that flow rate for both series-connected and parallel-connected flow configurations are discussed. Author

N73-19304# Mons Univ. (Belgium). Faculte Polytechnique.
STUDY OF OPTIMIZATION TECHNIQUES FOR COMPONENTS AND FLUIDIC CIRCUITS, AND THEIR APPLICATION TO THE CONSTRUCTION OF A THREE-STAGE PROPORTIONAL AMPLIFIER [ETUDE DE METHODES DE CONCEPTION OPTIMISEES DE COMPOSANTS ET DE CIRCUITS FLUIDIQUES ET LEUR APPLICATION A LA CONSTRUCTION D'UN AMPLIFICATEUR CONTINU A TROIS ETAGES]
Pierre Bernimolin Brussels Centre de Rech. Sci. et Tech. de l'Ind. Des Fabric. Metal. Nov. 1972 62 p refs In FRENCH
(CRIF-EL-6) Avail: NTIS HC $5.25

The problem of optimization of fluidic control elements, particularly fluid amplifiers, is discussed. A model was designed in order to evaluate the amplification. Local measurements with a pitot tube and a hot wire anemometer were carried out to evaluate the stagnation pressure and flow velocity distribution in the jet. The amplification was expressed by means of two parameters used to optimize the system. A three-component cascade of amplifiers is also discussed. The optimization of the integrated amplifiers was achieved by analysis of an equivalent electric circuit. Results obtained are compared with experimental data. The model is found to be valid. ESRO

N73-19305# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE DEVELOPMENT OF A LASER DOPPLER VELOCITY METER FOR THE MEASUREMENT OF SOLID PARTICLE VELOCITY IN A TWO-PHASE FLOW
R. H. Barker, M. L. Riethmuller, and J. J. Ginoux Oct. 1972 63 p refs
(VKI-TN-81) Avail: NTIS HC $5.25

A laser-Doppler fringe velocity meter was developed for the measurement of the velocity of solid particles (diameter up to 500 microns) in a two-phase flow. Simple optical equipment and low laser power (less than 1 milliwatt) was used. The potential for a higher signal-to-noise ratio and the ease of alignment made the fringe technique more appealing than other laser-Doppler methods for the present application of velocity measurements between zero and 20 meters per second. A rotating simulation wheel with small wires of 100 to 500 microns in diameter, was used during the development. The results demonstrate the interest of a fringe laser-Doppler system to measure the velocity of particles of much greater size than the average fringe spacing. For a fringe separation of about 35 microns, velocity measurements were made of 100 and 500 micron spherical glass particles in a gas nozzle flow. The system may be extended to a much larger velocity range by utilizing the full power of the 1 milliwatt He-Ne laser. Author (ESRO)

N73-19306# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AN APPROXIMATE CALCULATION OF THE LAMINAR HEAT TRANSFER IN THE STAGNATION REGION OF SPHERES AND CYLINDERS IN HIGH SPEED FLOWS
Hans W. Stock Oct. 1972 29 p refs
(VKI-TN-84) Avail: NTIS HC $3.50

An approximate method is given for calculation of the laminar heat transfer in the stagnation region of isothermal spheres and cylinders in high speed flows of a perfect gas. A simplified expression is developed for the Mach number dependence of the heat transfer in the stagnation point. The present method is compared with existing theories and experimental results. Author (ESRO)

N73-19307# National Aerospace Lab., Amsterdam (Netherlands).
A SEMI-EMPIRICAL MODEL FOR THE DEVELOPMENT OF A ROUND TURBULENT JET IN A CROSS FLOW
H. Snel 6 Dec. 1971 83 p refs Sponsored by Neth. Agency for Aerospace Programs
(NLR-TR-71107-U) Avail: NTIS HC $6.25

A semiempirical model is presented for the calculation of the development of a round turbulent jet in a cross flow. The jet flow is divided in to a development region and a region of fully developed flow, the first having the length of the potential core. In the developed region, certain similarity assumptions are used and the measured velocity decay along the jet axis is employed as empirical input. An asymptotic solution of the equations for the jet excess velocity tending to zero describes the jet behavior far downstrem. Comparison of the calculations with measureaments shows that the proposed model is able to predict the entire jet development in a reasonably accurate way. Author (ESRO)

N73-19308# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NON-STATIONARY FLOW OF AN ANOMALOUS VISCOUS LIQUID
O. K. Fedorov 17 Nov. 1972 10 p refs Transl. into ENGLISH from Tr. Tekhnol. Inst. Tsellyuloz.-Bumazh. Prom. (Leningrad), no. 25, 170 p 222-224
(AF Proj. 7343)
(AD-753486; FTD-HT-23-1120-72) Avail: NTIS CSCL 20/4

The author solves the problem of a nonstationary flow in half space of liquid (the problem of Rayleigh), having particular properties of displacement speed and viscosity. It is assumed

that the liquid was initially at rest. At the initial moment of time the surface, on top of which the liquid is found, begins to move with constant speed. Thus a boundary arises separating liquids with differing viscosities. The solution is expressed through a Laplace function. GRA

N73-19309# Tel-Aviv Univ. (Israel). Dept. of Mathematical Sciences.
HIGHER ORDER ACCURACY FINITE DIFFERENCE ALGORITHMS FOR QUASI-LINEAR, CONSERVATION-LAW HYPERBOLIC SYSTEMS
S. Abarbanel and D. Gottlieb Feb. 1972 46 p refs
(Contract F61052-69-C-0041; AF Proj. 9783)
(AD-753097; AFOSR-72-0812TR) Avail: NTIS CSCL 20/4

An explicit algorithm that yields finite difference equations that approximate the quasi-linear hyperbolic system to any desired accuracy, for an arbitrary number of space dimensions, is presented. Analytic stability proofs and criteria, in the case of one dimension for arbitrary order of accuracy, are given. Analytic stability proofs in the higher order Author (GRA)

N73-19310# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FURTHER STUDIES ON THE DISSOCIATION OF HBr BEHIND SHOCK WAVES Technical Report, Jul. 1969 - Jun. 1972
Norman Cohen, Robert R. Giedt, and Theodore A. Jacobs 30 Nov. 1972 43 p refs
(Contract F04701-72-C-0073)
(AD-753395; TR-0073(3240-40)-1; SAMSO-TR-72-291) Avail: NTIS CSCL 07/4

Previously reported shock tube studies of the dissociation of HBr in the temperature range of 2100-4200K have been extended to lower temperatures (1450-2300K) in pure HBr. The results imply that, in the lower range of temperatures, the activation energy of dissociation can be approximated by the HBr bond energy (88 kcal/mole). It was also found that, in this temperature range, the rate of HBr dissociation is sensitive to the Br2 dissociation rate and the HBr Br exchange rate. It was found that the higher temperature data could also be fitted reasonably well with an HBr dissociation activation energy of 88 kcal/mole, contrary to the conclusions of previous work. A detailed review is given of the rate coefficients for the other pertinent reactions in the H2-Br2 system; namely, Br2 dissociation and reactions of HBr with H and Br. GRA

N73-19311# Northrop Corp., Hawthorne, Calif. Aircraft Div.
THE CALCULATION OF THREE DIMENSIONAL SUPERSONIC FLOWS AROUND SPHERICALLY-CAPPED SMOOTH BODIES AND WINGS. VOLUME 1: THEORY AND APPLICATION Final Report, 1 Dec. 1971 - 3 Jul. 1972
Chong-Wei Chu and Sidney A. Powers Sep. 1972 88 p refs
(Contract F33615-72-C-1429; AF Proj. 1366)
(AD-753695; NOR-72-87-Vol-1; AFFDL-TR-72-91-Vol-1) Avail: NTIS CSCL 20/4

The report describes the theories, the numerical methods and the computer programs developed for determining the inviscid three-dimensional flow about smooth shapes at supersonic speeds. Volume 1 describes the theoretical and numerical approaches and compares two sample cases with experiment; a blunted 15 deg cone at 20 deg angle of attack in helium at M = 14.9, and a 70 deg slab delta wing at 15 deg angle of attack in air at M = 9.6. The numerical results are in close agreement with the experimental data. Author (GRA)

N73-19312# New York Univ., N.Y. Magneto-Fluid Dynamics Div.
SINGULAR LIMITS OF SOLUTIONS OF BOLTZMANN'S EQUATION
Harold Grad Oct. 1972 29 p refs
(Grant AF-AFOSR-2053-71)
(AD-753691; MF-77; AFOSR-72-1843TR) Avail: NTIS CSCL 07/4

A survey is made of various singular limits of solutions of the Boltzmann equation which, taken together, describe most of the qualitative and quantitative properties of a rarefied gas. Included are large and small mean-free-path limits, boundary and initial layers, and the influence of instabilities on the propagation of correlations by nonchaotic Boltzmann equations. Author (GRA)

N73-19313# Technology, Inc., Dayton, Ohio.
THE THREE-DIMENSIONAL LAMINAR ELLIPTICAL JET IN A COFLOWING STREAM
Herman Viets Dec. 1972 70 p refs
(Contract F33615-71-C-1463; AF Proj. 7116)
(AD-754227; ARL-72-0052) Avail: NTIS CSCL 20/4

A laminar jet issuing from a three-dimensional orifice of elliptical shape is analyzed by the use of the boundary layer assumptions in the mixing region of the jet. The full three-dimensional equations are reduced to a set of quasi-two-dimensional boundary layer equations. These equations are solved numerically and predict a decrease in the half width dimension of the major axis of the ellipse. This decrease has been observed in the case of three-dimensional turbulent jets but has not been predicted by any previous analysis. Author (GRA)

N73-19314# Systems Research Labs., Inc., Dayton, Ohio.
VELOCITY MEASUREMENTS IN PARTIALLY CONFINED RECTANGULAR JETS
Charles N. Eastlake, II Sep. 1972 41 p refs
(Contract F33615-70-C-1515; AF Proj. 7116)
(AD-754225; SRL-2911; ARL-72-0121) Avail: NTIS CSCL 20/4

An experimental investigation has been made of the mean flow characteristics of air jets issuing from rectangular outlets into a still atmosphere. Both nozzles and flat-plate orifices having aspect ratios (l/d) of 40 and 100 have been tested. Free jet data is compared with data from the jets confined by plane walls parallel to the jet axis on only two sides of the jet. Considerable differences in half-velocity widths and peak velocity decay are found to be caused by this partial confinement. Jet momentum flux and mass entrainment are less seriously affected. Author (GRA)

N73-19315# Systems Research Labs., Inc., Dayton, Ohio.
VELOCITY IRREGULARITIES IN THE NEAR FIELD OF HIGH ASPECT RATIO TURBULENT JETS
Charles N. Eastlake, II Nov. 1972 37 p refs
(Contract F33615-70-C-1515; AF Proj. 7116)
(AD-754224; ARL-72-0157) Avail: NTIS CSCL 20/4

An extensive investigation has been made to determine the cause of irregularities in the near field velocity profiles of turbulent jets issuing from rectangular openings of high aspect ratio. These irregularities are seen to persist for about two exit major diameters downstream. Various means of reducing the nonuniformities are documented, but it does not seem possible to produce completely smooth profiles from orifices or nozzles of this small scale (minor diameter = .060 inch) without manufacturing processes beyond normal tolerances. Author (GRA)

N73-19316# Brown Univ., Providence, R.I.
INTERACTION BETWEEN A SOUND FIELD AND NATURAL CONVECTION ON A HORIZONTAL CYLINDER
G. Devahl Davis and P. D. Richardson May 1972 70 p refs
(Contract AF 33(615)-1263; AF Proj. 7063)
(AD-754006; ARL-72-0076) Avail: NTIS CSCL 20/4

Sound and vibrations affect convective heat transfer. An oscillating flow field can induce Reynolds stresses in a boundary layer. These Reynolds stresses may affect the time-mean motion, or even be its sole cause. Solutions for convection by streaming alone have already been found, within the framework of boundary-layer analysis for a circular cylinder under transverse oscillations. Solutions are obtained here to the coupled momentum and energy boundary layer equations for the interaction of a transverse sound field with natural convection on a horizontal cylinder in terms of axiumthal series of functions of the (transformed) radial coordinate. The solutions treat the cases where the direction of oscillations, transverse to the cylinder, is either horizontal or vertical. It has been found that horizontal oscillations increase the heat transfer coefficient at the bottom of a heated cylinder, while vertical oscillations cause a decrease. Author (GRA)

N73-19317# Naval Ship Research and Development Center, Bethesda, Md.
THE XYZ POTENTIAL FLOW PROGRAM
Charles W. Dawson and Janet S. Dean Jun. 1972 70 p refs
(AD-754429; NSRDC-3892) Avail: NTIS CSCL 20/4

The XYZ Potential Flow Program is a FORTRAN program which computes approximate solutions to problems of flow about three-dimensional bodies of arbitrary shape. The surface of the body is approximated by a set of plane quadrilaterals. The solution is constructed in terms of a source density on the surface of the body. The integral equation for the source density is approximated by a matrix equation on the assumption that the source density is constant in each quadrilateral. The matrix equation is solved by an iteration procedure. A problem with 500 quadrilaterals requires about 15 minutes of computer time when run with CDC 6400 processor. A detailed discussion of the preparation of the input and a sample problem are included. Additional routines which compute streamlines on or off the body are described. Author (GRA)

N73-19318# Massachusetts Univ., Amherst. School of Engineering.
CALCULATION OF INLET FLOWS BY MEANS OF A CLOSED VORTICITY DISTRIBUTION APPLIED TO DUCTED PROPELLERS
Ronald J. Weetman and Duane E. Cromack Dec. 1972 106 p refs
(Contract N00014-68-A-0146; NR Proj. 200-016)
(AD-754114; UM-72-11) Avail: NTIS CSCL 20/4

The investigation concerns inlet flow calculations applied to ducted propellers. The analysis is classified as that of an inlet flow since the ducted propeller wake is assumed to be at a constant diameter. A closed distribution of ring vortices is used to describe the duct and wake. By forming a closed distribution, the velocity can be equated directly to the vorticity. With this representation, singular integral equation of the first kind is formulated for the vorticity in terms of the streamline enclosing the duct and wake. Several techniques incorporated in the numerical solution of this integral equation are presented. This analysis provides a needed solution for ducted propellers operating at low speeds and statically, as well as at high speeds.
Author (GRA)

N73-19319# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRAULIC RESISTANCES
Adolph A. Altshul 16 Oct. 1972 315 p refs Transl. into ENGLISH from the monograph "Gidravlicheskie Soprotivlenia" USSR, 1970 p 1-216
(AD-754322; FTD-HC-23-1290-72) Avail: NTIS CSCL 20/4

The wide range of pipeline constructions for varied purposes, plus other hydraulic systems for water, gas, petroleum and its by-products, air, steam, and other liquids and gases poses extremely complex technical problems. Among, these, a most important one is the correct hydraulic calculation of pipelines.
Author (GRA)

N73-19320# Aeronautical Research Inst. of Sweden, Stockholm.
TRANSONIC FLOW AT A SLOTTED TEST SECTION WALL Interim Scientific Report, 1 Oct. 1971 - 30 Sep. 1972
Sune B. Berndt and Hans Sorensen 29 Oct. 1972 25 p refs
(Grant AF-AFOSR-2184-72; AF Proj. 9781)
(AD-753911; AFOSR-72-2459TR) Avail: NTIS CSCL 14/2

The aim is to arrive at a better understanding of the structure of slot flow under different conditions (inflow, outflow, presence of wall boundary layers, etc.) in order to compute wall corrections with required accuracy. As a first step towards this end, using simple and available tools, the investigation is concerned with: (1) Experimental study of slot flow in a small transonic wind tunnel; (2) Elementary theoretical analysis of slot flow with a schematic boundary layer; (3) Numerical computation of near-sonic flow in a slotted test section using simplified boundary conditions. Author (GRA)

N73-19321# Naval Academy, Annapolis, Md. Michelson Physical Lab.
FLUCTUATING PIPE PRESSURES PRODUCED BY MODULATED JET FLOW Interim Technical Report
Samuel A. Elder Dec. 1972 78 p refs
(NR Proj. 184-803)
(AD-754422; TR-E-7204) Avail: NTIS CSCL 20/1

The precise way in which sound pressure fluctuations are produced by the interaction of a jet and resonator remains in dispute. The report suggests that two current theories for the sound production mechanism may be comprehended by a more general approach, based on conservation of linear momentum and conservation of mass. Equating force per unit area exerted by the jet on a control volume containing the mixing region to the difference in pressure along the pipe axis leads to an expression for acoustic particle velocity in the standing wave as a function of the jet driving flow spectrum. Author (GRA)

N73-19322# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
COMBINED FORCED AND FREE CONVECTION FOR CO-AXIAL HORIZONTAL CYLINDERS Interim Report
Kenneth R. Cramer and Frank C. Jarvis May 1972 27 p ref
(AF Proj. 7063)
(AD-754017; ARL-72-0080) Avail: NTIS CSCL 20/4

Experimental results and their correlation are presented for the combined forced and free convection in the annular region of horizontal co-axial cylinder. Results demonstrate that the heat transferred from the inner cylinder can be correlated on the basis of diameter ratio, Grashoff, Reynolds, and Prandtl numbers. Nusselt numbers for carbon dioxide do not correlate with air and argon according to the Prandtl number but, are ordered inversely with their viscosities. Free convection Nusselt numbers increase with the diameter ratio whereas those for forced convection decrease. Thermal radiation produces an apparent increase in the Nusselt number for all Grashoff and Reynolds number. A critical Reynolds number exists for which the heat transfer becomes independent of the influence of free convection. Author (GRA)

N73-19796 United Aircraft Corp., East Hartford, Conn. Research Labs.
PRACTICAL CALCULATIONS OF TRANSITIONAL BOUNDARY LAYERS
H. McDonald and R. W. Fish *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 29-53 refs (For availability see N73-19794 10-28)

N73-19797 National Gas Turbine Establishment, Pyestock (England).
PREDICTIONS OF BOUNDARY LAYER TRANSITION ON TURBOMACHINERY BLADES
J. Dunham *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 55-71 refs (For availability see N73-19794 10-28)

N73-19798 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
INFLUENCE OF THE DEGREE OF TURBULENCE ON THE AERODYNAMIC COEFFICIENTS OF CASCADES
R. Kiock *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 73-88 refs (For availability see N73-19794 10-28)

N73-19799 Detroit Diesel Allison, Indianapolis, Ind.
THE EFFECT OF FREE STREAM TURBULENCE LEVEL ON TURBULENT BOUNDARY LAYER BEHAVIOUR
G. David Huffman, D. R. Zimmerman, and W. A. Bennett *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 89-115 refs (For availability see N73-19794 10-28)

N73-19800 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
ANALYTICAL APPROACH FOR THE LOSS AND DEFLECTION BEHAVIOUR OF CASCADES IN TRANSONIC FLOW INCLUDING AXIAL MASS FLOW VARIATION
Leonhard Fottner *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 119-139 refs (For availability see N73-19794 10-28)

N73-19802 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.
INCOMPRESSIBLE FLOW THROUGH CASCADES WITH SEPARATION
W. Geller *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 171-186 refs (For availability see N73-19794 10-28)

N73-19803 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFLUENCE OF ANGLE OF ATTACK AND DEFLECTION ON BOUNDARY LAYER FLOW IN UPRIGHT CASCADE BLADES [INFLUENCE DE L'ANGLE D'ATTAQUE ET DE LA DEFLEXION SUR LE DECOLLEMENT DE LA COUCHE LIMITE DANS UNE GRILLE D'AUBES DE REDRESSEUR]
Jacques Paulon *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 187-201 refs In FRENCH (For availability see N73-19794 10-28)

N73-19804 Technische Universitaet, Brunswick (West Germany). Inst. fuer Stroemungsmechanik.
THE EFFECT OF AXIAL VELOCITY RATIO ON THE AERODYNAMIC COEFFICIENTS OF A COMPRESSOR CASCADE IN VISCOUS FLOW
U. Stark *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 205-220 refs (For availability see N73-19794 10-28)

N73-19805 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
THE INFLUENCE OF AXIAL VELOCITY DENSITY RATIO ON COMPRESSOR CASCADE PERFORMANCE IN COMPRESSIBLE FLOW
W. Heilmann *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 221-240 refs (For availability see N73-19794 10-28)

N73-19806 Rolls-Royce, Ltd., Bristol (England).
THE ROLE OF BOUNDARY LAYERS IN AXIAL FLOW TURBOMACHINES AND THE PREDICTION OF THEIR EFFECTS
N. J. Seyb *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 241-259 refs (For availability see N73-19794 10-28)

N73-19808 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
METHOD OF CALCULATING THREE DIMENSIONAL TURBULENT BOUNDARY LAYER SEPARATION WITH APPLICATION TO A SIMPLE TURBOMACHINE CASE [METHODE DE CALCUL DE LA COUCHE LIMITE TURBOULENTE TRIDIMENSIONNELLE JUSQU'A LA SEPARATION APPLICATION A UN CAS SIMPLE DE TURBOMACHINE]
R. Michel *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 277-292 refs In FRENCH; ENGLISH summary (For availability see N73-19794 10-28)

N73-19809 Institute TNO for Mechanical Constructions, Delft (Netherlands).
MEASURED AND CALCULATED TURBULENT BOUNDARY LAYER FLOW IN A VANELESS RADIAL DIFFUSER
C. B. V. D. Voorde and J. Bos *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 293-310 refs (For availability see N73-19794 10-28)

N73-19810 Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
APPLICATION OF BOUNDARY LAYER FENCES IN TURBOMACHINERY
H. Pruemper *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 311-331 (For availability see N73-19794 10-28)

N73-19811 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SECONDARY FLOW RESEARCH AT THE VON KARMAN INSTITUTE
J. W. Salvage *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 333-361 refs (For availability see N73-19794 10-28)

N73-19813 Cambridge Univ. (England).
PREDICTION OF ANNULUS WALL BOUNDARY LAYERS IN AXIAL FLOW TURBOMACHINES
M. Daneshyar, J. H. Horlock, and H. Marsh *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 375-392 refs (For availability see N73-19794 10-28)

N73-19814 Technische Hochschule, Aachen (West Germany).
ANNULUS WALL BOUNDARY LAYERS IN AXIAL FLOW TURBOMACHINES
W. Bitterlich and K. Rubner *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 393-413 refs (For availability see N73-19794 10-28)

N73-19815 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESULTS OF INTERACTION OF SHOCK WAVE WITH TURBULENT BOUNDARY LAYERS AT MODERATE MACH SUPERSONIC NUMBERS [RESULTATS SUR L'INTERACTION CHOC-COUCHE LIMITE TURBULENTE A DES NOMBRES DE MACH MODEREMENT SUPERSONIQUES]
J. Delery and J. C. LeBalleur *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 419-440 refs In FRENCH; ENGLISH summary (For availability see N73-19794 10-28)

N73-19816 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SHOCK WAVE BOUNDARY LAYER INTERACTION IN CASCADES
H. Griepentrog *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 441-456 refs (For availability see N73-19794 10-28)

N73-19629 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany).
ERROR SOURCES IN TURBULENT PRESSURE FLUCTUATION MEASUREMENTS WITH FLOW AROUND MICROPHONES [FEHLERQUELLEN BEI DER MESSUNG TURBULENTER DRUCKSCHWANKUNGEN MIT UMSTROEMTEN MIKROFONEN]
H. Fuchs *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 93-103 refs In GERMAN (For availability see N73-19623 10-21)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-19323 Institute of Geological Sciences, London (England).
MAGNETIC RESULTS 1969, ESKDALEMUIR, HARTLAND AND LERWICK OBSERVATORIES
1973 159 p
(Bull-3) Copyright. Avail: HMSO £4; PHI $15.50

Variometers, magnetograms, and absolute instruments were used to measure magnetic properties from 3 observatories in Great Britain. The data is presented in tabular form, including diurnal variations and hourly mean values. J.A.M.

N73-19324 California Univ., Los Angeles.
PITCH-ANGLE DIFFUSION OF RADIATION BELT PARTICLES WITHIN THE PLASMASPHERE Ph.D. Thesis
Lawrence Robert Lyons 1972 121 p
Avail: Univ. Microfilms Order No. 72-23785

The formation of the quiet-time slot, which divides radiation belt electrons into an inner and outer zone is explained. Electron pitch-angle diffusion resulting from cyclotron resonant interactions with whistler-mode waves in a uniform magnetic field is studied. It is found that diffusion rates generally decrease with increasing harmonic number n. A quantitative investigation of the pitch-

angle diffusion of radiation belt electrons resulting from resonant interactions with the observed plasmaspheric whistler-mode wave band is presented. The effects of wave propagation obliquely to the geomagnetic field direction with the resulting diffusion at all cyclotron harmonic resonances and the Landau resonance are evaluated, along with the effects of interactions occurring at all geomagnetic latitudes. Dissert. Abstr.

N73-19325 Colorado State Univ., Fort Collins.
HAZE EFFECTS ON INFRARED REMOTE SENSING IN THE TROPICAL NORTH ATLANTIC Ph.D. Thesis
James Clifford Harlan 1972 142 p
Avail: Univ. Microfilms Order No. 72-22573

The role of atmospheric aerosol particles in the infrared radiation transfer process was examined. Two hypotheses are set forward. One is that the effects of atmospheric particulates could be demonstrated to be an important consideration in studies requiring accurate sea surface temperature measurements by aircraft or satellite-borne infrared radiometers. The second is that the particulate effects could be simulated accurately from data of several atmospheric parameters including concentrations of aerosol particles. The method used to determine the particulate effects was developed by combining the results of a Mie scattering computer program for particulate effects with an atmospheric radiation transfer program. The Mie scattering program was used to provide scattering, absorption, and extinction volume cross sections for aerosol particle concentrations determined from data obtained during the BOMEX (Barbados Oceanographic and Meteorological Experiment, Summer 1969) measurement program. Dissert. Abstr.

N73-19326 St. Louis Univ., Mo.
THE LOCAL SURFACE ENERGY BALANCE AND SUBSURFACE TEMPERATURE REGIME IN ANTARCTICA Ph.D. Thesis
Thomas Willard Schlatter 1972 118 p
Avail: Univ. Microfilms Order No. 72-24013

To gain a better understanding of the physical processes taking place within a perennial snow cover and at its surface, the monthly variation of the local surface energy budget and sub-surface temperature regime in Antarctica was simulated. The model is driven by solar heating and atmospheric forcing for one year. It accounts for penetration of solar radiation into snow with variable liquid water content and for sub-surface transfer of sensible and latent heat. There is an original treatment of production, percolation, and refreezing of meltwater. The model successfully generates the major features of the surface energy balance and the temperature regime in the snow at Mirny and Pionerskaya during 1958. Dissert. Abstr.

N73-19327 Utah Univ., Salt Lake City.
AN INVESTIGATION OF THE SPECTRAL STRUCTURE OF ATMOSPHERIC WAVES IN MIDDLE LATITUDES Ph.D. Thesis
Ching-Yen Tsay 1972 146 p
Avail: Univ. Microfilms Order No. 72-23607

An analysis of the average power spectra of the zonal and meridional components of the velocity for winters and summers shows that in the frequency range, 5 to 30 cycles/90 days, the power spectra are approximately proportional to 1/n. In the frequency higher than 30 cycles/90 days, the slope of the spectra increases with increasing latitude. An investigation of the nonlinear interaction near the center of maximum mean motion of a jet stream indicates that interactions of waves of low frequencies and the effect of mean zonal motion contribute most to the low frequency range of the energy spectrum. In ranges of intermediate and high frequencies, the interactions between the mean zonal motion and waves contribute most to the respective spectra. Dissert. Abstr.

N73-19328 North Carolina State Univ., Raleigh.
AN EXPERIMENTAL INVESTIGATION OF THE SODIUM D2 RADIATION FROM THE EARTH'S ATMOSPHERE DURING THE DAY Ph.D. Thesis
Daniel Joseph McMahon 1972 131 p
Avail: Univ. Microfilms Order No. 72-24091

A photometric system utilizing a sodium vapor resonance cell was designed, constructed, and used to observe the sodium D2 line emission from the daytime sky. The system performance was evaluation in the laboratory and by observation of the atmospheric sodium D2 line emission during twilight. The laboratory evaluation yielded results in agreement with theoretical predictions for the system performance. The system was calibrated on an absolute basis using a standard quartz iodine lamp in conjunction with a laboratory line source. An evaluation was made of the system response to the line source as a representation of the response to the atmospheric line. Data on the daytime atmospheric sodium emission were collected over a four month period from September through December, 1970, at Raleigh, North Carolina. Dissert. Abstr.

N73-19329 Texas A&M Univ., College Station.
THE ACCELERATION AND PRECIPITATION OF NIGHTSIDE AURORAL PARTICLES Ph.D. Thesis
James Randall Sharber 1972 272 p
Avail: Univ. Microfilms Order No. 72-24331

Low-energy particle measurements by the Soft Particle Spectrometer on the ISIS-1 polar orbiting satellite reveal a number of clues as to the mechanisms acting to produce auroral particles. Nightside particle precipitation patterns are presented in the format of the energy-time spectrogram, which shows differential spectral measurements over the range 10 eV to 10 keV for electrons and protons. Four of the passes are compared with auroral activity as recorded by all-sky cameras. The nightside observations show that in the midnight sector electrons and protons are often precipitated simultaneously, and the spectral measurements generally indicate a gradual increase in the average particle energy with decreasing latitude in the auroral zone. In addition the rotational scanning provided by the spinning satellite shows a change in the angular distribution from field aligned at high latitude to isotropic at low latitudes. Dissert. Abstr.

N73-19330*# National Oceanic and Atmospheric Administration, Miami, Fla.
REMOTE SENSING OF OCEAN CURRENTS Bimonthly Report, 4 Jan. - 4 Mar. 1973
George A. Maul, Principal Investigator 4 Mar. 1973 8 p (NASA Order S-70246-AG)
(E73-10022; NASA-CR-130835) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-19331*# Louvain Univ. (Belgium).
THE MANKOYA-KOLWEZI STRIP (ZAMBIA, ZAIRE)
Jan DePloey, Principal Investigator and Josef Sterckx 1973 16 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(E73-10293; NASA-CR-130576; Rept-2) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-19332*# Louvain Univ. (Belgium).
THE NDOLA-MWERU WANTIPA STRIP (ZAMBIA, ZAIRE)
Jan DePloey, Principal Investigator and Josef Sterckx 1973 17 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(E73-10294; NASA-CR-130577; Rept-1) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-19333*# Servicio Geologico de Bolivia, La Paz.
SKETCH ON THE STRUCTURAL GEOLOGY AND VULCANISM IN THE CENTRAL HIGH PLATEAU OF THE BOLIVIAN ANDES [BOQUEJO SOBRE LA GEOLOGIA ESTRUCTURAL YE L VULCANISMO EN EL ALTIPLANO CENTRAL DE LOS ANGES BOLIVIANOS]
Carlos E. Brockmann, Principal Investigator Jan. 1973 18 p In SPANISH Sponsored by NASA
(E73-10296; NASA-CR-130791) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. The Earth Resources Technology Satellite Program has as an objective the development of tectonic maps for Bolivia. Maps were prepared using the images of ERTS-1 in a preliminary

study of alignments observed and rapidly interpreted in images 1010-14033-3-4-5-6-7 on a scale of 1:1,000,000, and later verified on the ground with corresponding fault zones. This information was not shown on existing geologial maps. The ERTS-1 imagery was used in volcanology research for drawing the regional limits of volcanic formations as soon as the alignment and the extent of the volcanoes could be determined. The extensive coverage of ERTS-1 images provides an excellent opportunity for developing studies of regional structures. Transl. by F.O.S.

N73-19334*# Spectral Africa (Pty) Ltd., Randfontein (Republic of South Africa).
GROWTH AND DECLINE OF VEGETATION ON MINE DUMPS Progress Report, Nov. 1972 - Jan. 1973
B. P. Gilbertson, Principal Investigator Jan. 1973 32 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(E73-10326; NASA-CR-130781; Rept-73-3) Avail: NTIS HC $3.75 CSCL 08F

The author has identified the following significant results. The main objective is to determine the extent to which can be used to differentiate between mine dumps having varying degrees of vegetative cover. At this stage it is clear that the various mine dumps can be located and identified. Differences in vegetative cover can be seen and measured. Patterns of vegetative growth, some characteristic to particular dumps, can also be seen. It is therefore tentatively concluded that mine dumps can be differentiated with respect to their vegetative cover on the imagery received to date, and this is reported as a significant result. Subsequent imagery showing seasonal variations should facilitate this program. In addition to work on the mine dumps, a photogeological project has been initiated on geotectonics of South Africa. Studies of ERTS-1 images has indicated that major structures (faults, folds, and linear features) associated with the three geotectonic environments can be identified. In addition, major as well as relatively minor stratigraphic subdivisions can be recognized by their color tones. Results obtained warrant continuation of this study using color composite prints enlarged to a scale of 1:500,000.

N73-19335*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, period ending 28 Feb. 1973
Roland S. Yunghans, Edward B. Feinberg, and Frank J. Wobber, Principal Investigators 2 Mar. 1973 9 p Prepared for N. J. Dept. of Environ. Protect.
(Contract NAS5-21765)
(E73-10330; NASA-CR-130773) Avail: NTIS HC $3.00 CSCL 08C

The author has identified the following significant results. Photomaps, using MSS bands 5 and 7, have been prepared delineating the coastal zone as described in the Coastal Area Facility Review Act before the State Legislature. An upper wetlands boundary overlay has been prepared at 1:500,000 scale. The movement and dispersion of wastes in the New York Bight area are being plotted with each orbit. The possible impact of these wastes on the New Jersey shoreline is being quantified.

N73-19336*# Bureau of Sport Fisheries and Wildlife, Washington, D.C.
AN EVALUATION OF ACQUIRED DATA AS A TOOL FOR MANAGEMENT OF WILDLIFE HABITAT IN ALASKA Progress Report, 1 Jan. - 28 Feb. 1973
Bill J. VanTries, Principal Investigator 1 Mar. 1973 3 p
(NASA Order S-70243-AG-1)
(E73-10335; NASA-CR-130785) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Density sliced and digitized imagery of the Kuskokwin/Yukon Delta were analyzed. Color coded images of the isodensity displays were compared with existing vegetation maps of the ERTS-1 frames for the Yukon/Kuskokwin area. A high degree of positive correlation was found to exist between the ERTS-1 image and the conventionally prepared maps. Hydrologic phenomena were also analyzed. Digitization on South Dakota State Remote Sensing Center's SADE system provide some discrimination among several large lakes in the subject area. However, interpretation must await ground observations and depth measurements. An attempt will be made to classify large water bodies by depth classes.

N73-19337*# Bureau of Reclamation, Denver, Colo.
APPLICATION OF REMOTE SENSING TO SELECTED BUREAU OF RECLAMATION PROJECTS Progress Report, 1 Jan. - 28 Feb. 1973
Larry D. Cast, Principal Investigator 1 Mar. 1973 2 p
(NASA Order S-70243-AG)
(E73-10336; NASA-CR-130786) Avail: NTIS HC $3.00 CSCL 14E

There are no author-identified significant results in this report.

N73-19338*# Geological Survey, Washington, D.C.
THE UTILIZATION OF ERTS-1 GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENTS Progress Report, 1 Jan. - 28 Feb. 1973
Daniel B. Krinsley, Principal Investigator 28 Feb. 1973 3 p
(NASA Order S-70243-AG-3)
(E73-10339; NASA-CR-130789) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-19339*# Geological Survey, Washington, D.C.
LAND USE MAPPING AND MODELLING FOR THE PHOENIX QUADRANGLE Progress Report, 1 Jan. - 28 Feb. 1973
John L. Place, Principal Investigator 1 Mar. 1973 7 p
(NASA Order S-70243-AG)
(E73-10340; NASA-CR-130790) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Comparison of 9 x 9 MSS band images and color composites made from bands 4, 5, and 6 showing vegetated areas near Phoenix during the summer and fall seasons aided in definitely establishing that certain land areas were being used as agricultural land and not as rangeland. Agricultural land, which appeared to be fallow, idle, or not irrigated, often became more readily identifiable as agricultural land when comparing different images of identical land areas which have been affected by seasonal vegetation changes. Experimentation with color density slicing portions of 9 x 9 MSS band 7 transparency showing the central urban core of Phoenix enabled dense commercial and industrial areas to be separated from less dense urbanized land uses; however, loss of resolution produced results of limited usefulness. The best results in agricultural areas near Sun City were obtained using MSS band 5 imagery. Discrimination of different land uses in both urban and agricultural areas which were color density sliced was not possible to the degree of accuracy necessary to make mapping feasible. Examination of MSS transparencies and color composites allowed updating of a map of land use change in the Phoenix Quadrangle.

N73-19340*# Ecole Pratique des Hautes Etudes, Paris (France).
MARSHES AND TURBID WATERS IN THE FRENCH ATLANTIC LITTORAL Progress Report, Oct. 1972 - Feb. 1973
Fernand Verger, Principal Investigator 28 Feb. 1973 43 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(E73-10341; NASA-CR-130800) Avail: NTIS HC $4.25 CSCL 08C

The author has identified the following significant results. The multispectral information provided by ERTS-1 is very rich for the coastal regions but the cloud cover, even when only partial, often cuts up the data, and lessens its practical value. The research by densitometric methods has thus far been the most fruitful. It consists of measuring densities along preferential axes. This method has enabled the investigators to perfect a system of computer cartography for the best image. Comparative study of microdensitometric transects in four MSS bands for carefully dilimited profiles on the ground, makes it possible to isolate and recognize various types of countryside: (1) countryside of coastal plains; (2) countryside of coastal sand dunes and beaches; and (3) forms and processes of offshore domains. This

Study shows the usefulness of the ERTS program in establishing a rapid cartography of the physiographic units of the coastal plains in the interest of a rational program of exploitation and development.

N73-19341*# TRW Systems Group, Redondo Beach, Calif.
EVALUATION OF DIGITAL CORRECTION TECHNIQUES FOR ERTS IMAGES Semiannual Report, Sep. 1972 - Feb. 1973
Samuel S. Rifman, Principal Investigator Mar. 1973 26 p Original contains imagery. Orginal photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21814)
(E73-10342; NASA-CR-130801) Avail: NTIS HC $3.50 CSCL 14E

There are no author-identified significant results in this report.

N73-19342*# Iowa State Univ. of Science and Technology, Ames. Agriculture Experiment Station.
REMOTE SENSING IN IOWA AGRICULTURE: IDENTIFICATION AND CLASSIFICATION OF IOWA CROP LAND USING ERTS-1 AND COMPLIMENTARY UNDERFLIGHT IMAGERY Semiannual Report, period ending Feb. 1973
R. E. Carlson and J. P. Mahlstede, Principal Investigators 14 Mar. 1973 13 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21839)
(E73-10343; NASA-CR-130802) Avail: NTIS HC $3.00 CSCL 20C

There are no author-identified significant results in this report.

N73-19343*# Aerospace Corp., Los Angeles, Calif.
STUDY TO DEMONSTRATE THE FEASIBILITY OF AND DETERMINE THE OPTIMUM METHOD OF REMOTE HAZE MONITORING BY SATELLITE Progress Report
Ernest H. Rogers, Principal Investigator 30 Nov. 1972 3 p
(Contract NAS5-21719)
(E73-10344; NASA-CR-130803) Avail: NTIS HC $3.00 CSCL 03B

There are no author-identified significant results in this report.

N73-19344*# Earth Satellite Corp., Washington, D.C.
FACILITATING THE EXPLOITATION OF ERTS IMAGERY USING SNOW ENHANCEMENT TECHNIQUES Bimonthly Progress Report, 1 Jan. - 28 Feb. 1973
Frank J. Wobber, Principal investigator, Kenneth Martin, and Roger Amato 1 Mar. 1973 35 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21744)
(E73-10345; NASA-CR-130804) Avail: NTIS HC $3.75 CSCL 08L

The author has identified the following significant results. New fracture detail within New England test area has been interpreted from ERTS-1 images. Comparative analysis of snow-free imagery (1096-15065 and 1096-15072) has demonstrated that MSS bands 5 and 7 supply the greatest amount of geological fracture detail. Interpretation of the first snow-covered ERTS-1 images (1132-15074 and 1168-15065) in correlation with ground snow depth data indicates that a heavy blanket of snow (less than 9 inches) accentuates major structural features while a light dusting (greater than 1 inch) accentuates more subtle topographic expressions. Snow cover was found to accentuate drainage patterns which are indicative of lithological and/or structural variations. Snow cover provided added enhancement for viewing and detecting topographically expressed fractures and faults. A recent field investigation was conducted within the New England test area to field check lineaments observed from analysis of ERTS-1 imagery, collect snow depth readings, and obtain structural joint readings at key locations in the test area.

N73-19345*# Aerospace Corp., Los Angeles, Calif. Space Physics Lab.
REMOTE HAZE MONITORING BY SATELLITE: A STUDY TO DEMONSTRATE THE FEASIBILITY AND DETERMINE THE OPTIMUM METHOD Interim Report, May - Sep. 1972
Ernest H. Rogers, Principal Investigator Mar. 1973 33 p refs
(Contract NAS5-21719)
(E73-10346; NASA-CR-130805) Avail: NTIS HC $3.75 CSCL 03B

The author has identified the following significant results. A general purpose flexible computer program for the analysis of ERTS MSS data has been written for the Control Data 7600 computer. By putting all of the analysis operations into a separate subroutine the user may concentrate on the analysis. The problems of getting the information into the computer in convenient format is solved once and need not be tampered with each time a new analysis procedure is desired. The problems of getting information written by the XDS computers in 8 bit byte format into a convenient format for analysis on the 60 bit word format CDC 7600 computer are not trivial. A general purpose program to accomplish this has been written and is available from the investigators upon request.

N73-19346*# Geological Survey, Washington, D.C.
CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE (CARETS): A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM Progress Report, 1 Jul. - 31 Dec. 1972
Robert H. Alexander, Principal Investigator 1 Jan. 1973 60 p refs
(NASA Order S-70243-AG-3)
(E73-10347; NASA-CR-130806) Avail: NTIS HC $5.00 CSCL 05B

The author has identified the following significant results. Accomplishments have included: (1) completion of the research design for the USGS/CARETS demonstration project; (2) preparation of photomosaics and land use maps at a scale of 1:100,000 for entire area; (3) demonstration of the feasibility of extracting several categories of land use information from ERTS-1 MSS data for a portion of the CARETS region; (4) demonstration of the feasibility of detecting some significant land use changes on ERTS-1 imagery; (5) demonstration of the feasibility of attaching environmental impact significance to the remote sensor-derived land use data; (6) delivery of land use information derived from high altitude aircraft data to the Maryland state planning agency for use in its statewide land use inventory; (7) demonstration of high interest by other use groups in the test region in products and services provided by investigation; and (8) determination of the viability of setting up a computerized geographic information system as part of the CARETS investigation, to facilitate handling of sensor-derived land use data in a variety of formats to suit user requirements.

N73-19347*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF ERTS DATA FOR COLORADO MOUNTAIN ENVIRONMENTS USING ADP TECHNIQUES Bimonthly Progress Report, 1 Jan. - 28 Feb. 1973
R. M. Hoffer, Principal Investigator 28 Feb. 1973 8 p
(Contract NAS5-21880)
(E73-10348; NASA-CR-130815) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-19348*# Minnesota State Planning Agency, St. Paul.
LAND USE MANAGEMENT IN MINNESOTA Progress Report, 1 Jan. - 28 Feb. 1973
Joseph E. Sizer, Principal Investigator 28 Feb. 1973 10 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21801)
(E73-10352; NASA-CR-130833) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-19349*# Maine Dept. of Transportation, Augusta.
TO MAP THE DISTRIBUTION OF GLACIOFLUVIAL DEPOSITS AND ASSOCIATED GLACIAL LANDFORMS Progress Report
Raymond G. Woodman, Principal Investigator 13 Mar. 1973

1 p
(Contract NAS5-21747)
(E73-10353; NASA-CR-130834; PR-5) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-19350*# Long Island Univ., Greenvale, N.Y. Science and Engineering Research Group.
IN SITU SPECTRORADIOMETRIC QUANTIFICATION OF ERTS DATA Progress Report, Jul. - Dec. 1972
Edward F. Yost, Principal Investigator Dec. 1972 49 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21793)
(E73-10354; NASA-CR-130864; TR-21-1) Avail: NTIS HC $4.50 CSCL 08M

The author has identified the following significant results. Additive color photographic analysis of ERTS-1 multispectral imagery indicates that the presence of soil moisture in playas (desert dry lakes) can be readily detected from space. Time sequence additive color presentations in which 600-700 nm bands taken at three successive 18-day cycles show that changes in soil moisture of playas with time can be detected as unique color signatures and can probably be quantitatively measured using photographic images of multispectral scanner data.

N73-19351*# Argus Exploration Co., Newport Beach, Calif.
A RECONNAISSANCE SPACE SENSING INVESTIGATION OF CRUSTAL STRUCTURE FOR A STRIP FROM THE EASTERN SIERRA NEVADA TO THE COLORADO PLATEAU Progress Report, 1 Jan. - 28 Feb. 1973
Ira C. Bechtold, Principal Investigator 15 Mar. 1973 9 p
(Contract NAS5-21809)
(E73-10355; NASA-CR-130970) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Analysis of ERTS-1 MSS imagery over the southern Basin-Range Province of California, Nevada, and Arizona has led to recognition of regional tectonic control of volcanism, plutonism, mineralization, and fault patterns. This conclusion is the result of geologic reconnaissance of anomalies observed in ERTS-1 and Apollo-9 data, guided by intermediate scale U-2 photography, SLAR, and relevant geologic literature. In addition to regional tectonic studies, the ERTS-1 imagery provides a basis for detailed research of relatively small geologic features. Interpretation of ERTS-1 and Apollo-9 space imagery and intermediate scale X-15 and U-2 photography indicates the presence of a major fault zone along the California-Nevada state line, here named the Pahrump fault zone. Field mapping confirms previously unreported evidence of fault breaks in bedrock, along range fronts and in Quaternary alluvium and lake sediments. Regional gravity lows and fault traces within the Pahrump fault zone from a general left stepping en echelon pattern. The trend and postulated diplacement for this fault are similar to other major strike slip fault zones in the southern Basin-Range Province. A.L.

N73-19352*# National Environmental Satellite Service, Washington, D.C.
EVALUATION OF ERTS DATA FOR CERTAIN OCEANOGRAPHIC USES Progress Report, Jan. - Feb. 1973
Alan E. Strong, Principal Investigator Feb. 1973 2 p
(NASA Order S-70246-AG)
(E73-10356; NASA-CR-130971) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-19353*# Radio Corp. of America, Princeton, N.J.
METEOROLOGICAL UTILITY OF HIGH RESOLUTION MULTISPECTRAL DATA Progress Report, period ending 28 Feb. 1973
J. Danko, Principal Investigator 28 Feb. 1973 4 p
(Contract NAS5-21741)
(E73-10357; NASA-CR-130972) Avail: NTIS HC $3.00 CSCL 04B

There are no author-identified significant results in this report.

N73-19354*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
GEOLOGICAL ANALYSIS AND EVALUATION OF ERTS-A IMAGERY FOR THE STATE OF NEW MEXICO Progress Report, 23 Jul. 1972 - 14 Mar. 1973
Frank E. Kottlowski, Principal Investigator 14 Mar. 1973 10 p
(Contract NAS5-21861)
(E73-10358; NASA-CR-130973) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Coverage of approximately one-third of the test site had been received by January 31, 1973 and all of the images received were MSS products. Images recorded during the first two months of the ERTS-1 mission were of poor quality, owing largely to high ground reflectance. Later images were of better quality and MSS bands 5 and 7 have proven to be particularly useful. Features noted during visual inspection of 9 1/2 x 9 1/2 prints include major structural forms, vegetation patterns, drainage patterns, and outcrops of geologic formations having marked color contrasts. The Border Hills Structural Zone and the Y-O Structural Zone are prominently reflected in coverage of the Pecos Valley. A study of available maps and remote sensing material covering the Deming-Columbus area indicated that the limit of detection and the resolution of MSS products are not as good as those of aerial photographs, geologic maps, and manned satellite photographs. The limit of detection of high contrast features on MSS prints is approximately 1000 feet or 300 meters for linear features and about 18 acres for roughly circular areas.

N73-19355*# Agricultural Research Service, Chickasha, Okla.
INVESTIGATION OF USE OF SPACE DATA IN WATERSHED HYDROLOGY Progress Report, 10 Jun. 1972 - 30 Jan. 1973
Bruce J. Blanchard, Principal Investigator Mar. 1973 12 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(NASA Order S-70251-AG-4)
(E73-10359; NASA-CR-130974) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Ground truth data have been compiled and 256 rainfall runoff events have been used to detemine coefficients for two storm runoff equations that apply to the 20 study watersheds. Two scenes have been processed using CCT data. Data pertinent to each of the study watersheds have been excerpted from the tapes. A computer program and display technique has been developed to retrieve the data from irregular shaped areas and store it in a format that allows future display of only the area desired. Means, standard deviations, and distributions have been determined for extreme dry and extreme wet conditions in the dormant season. Mean digital values show some variation between watersheds when dry, but no significant differences when wet. Standard deviations of digital values diminish drastically under wet dormant conditions. Thus the standard deviations may be a good indicator of influence of moisture. Distributions of seven bit values show that odd numbers are prevalent and irregular distribution may influence some classification schemes now in use.

N73-19356*# Nebraska Univ., Lincoln.
SATELLITE IMAGERY FOR ASSESSING RANGE FIRE DAMAGE IN THE SANDHILLS OF NEBRASKA
James V. Drew, Principal Investigator, Paul M. Seevers, and Peter N. Jensen [1973] 11 p refs Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21756)
(E73-10360; NASA-CR-130975) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. Initial imagery from the first ERTS indicates that satellite-acquired data is of value in determining the location and extent of range fire in the Sand Hills region of Nebraska. Preliminary results suggest that it can also provide a tool for monitoring soil erosion by wind and evaluating the recovery of vegetation in burned areas.

N73-19357*# Environmental Research and Technology, Inc., Lexington, Mass.
EVALUATE THE APPLICATION OF ERTS-A DATA FOR DETECTING AND MAPPING SNOW COVER Bimonthly Progress Report, 31 Dec. 1972 - 28 Feb. 1973
James C. Barnes, Principal Investigator 15 Mar. 1973 11 p
(Contract NAS5-21802)
(E73-10361; NASA-CR-130982; ERT-P-407-4; BMPR-3) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Analysis of ERTS-1 data covering the test sites in the western United States indicate that the MSS-4 and 5 spectral bands are the most useful for detecting and mapping snow cover. Of these two bands, the MSS-5 is the most consistently useful, as snow-covered areas in some MSS-4 images are nearly saturated causing some loss of detail. Snow can be readily detected and can be distinguished from clouds through a number of interpretive keys. At the ERTS-1 resolution, numerous terrestrial features not visible in lower resolution meteorological satellite data can be detected. In addition to various natural features, man-made features such as roads, electric power lines, cultivated fields, and timber cuts are visible. In two cases analyzed for the Salt-Verde Watershed in Arizona, good agreement is observed between the location of the snowline as mapped from the ERTS-1 data and as depicted on aerial snow survey charts compiled within a few days of the ERTS-1 passage. Results indicate that the snowline can be mapped in more detail from ERTS-1 imagery than can be achieved by current aerial survey methods.

N73-19358*# American Univ., Washington, D.C.
MAPPING SOUTHERN ATLANTIC COASTAL MARSHLAND, SOUTH CAROLINA-GEORGIA, USING ERTS-1 IMAGERY
Richard R. Anderson, Principal Investigator, Virginia Carter, and John W. McGinness [1973] 9 p refs Presented at Remote Sensing Conf., Tenn. Univ. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21752)
(E73-10362; NASA-CR-130995) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Southeastern coastal marshes are among the most extensive and productive in the United States. A relatively low cost, moderately accurate method is needed to map these areas for management and protection. Ground based and low altitude aircraft methods for mapping are time consuming and quite expensive. The launch of NASA's ERTS-1 has provided an opportunity to test the feasibility of mapping wetlands using small scale imagery. The test site selected was an area from the South Carolina border to Saint Catherine's Island, Georgia. Results of the investigation indicate that the following may be ascertained from ERTS-1 imagery: (1) upper wetland boundary; (2) drainage pattern in the wetland; (3) plant communities such as Spartina alterniflora, Spartina patens, Juncus roemerianus; (4) ditching activities associated with agriculture; (5) lagooning for water-side home development. Conclusions are that ERTS-1 will be an excellent tool for many types of coastal wetland mapping.

N73-19359*# American Univ., Washington, D.C.
MAPPING NORTHERN ATLANTIC COASTAL MARSHLANDS, MARYLAND-VIRGINIA, USING ERTS IMAGERY
Richard R. Anderson, Principal Investigator, Virginia Carter, and John W. McGinness [1973] 11 p Presented at Remote Sensing Conf., Tenn. Univ. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21752)
(E73-10363; NASA-CR-130996) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. ERTS-1 data provides repetitive synoptic coverage for analysis of wetland ecology, detection of change, and mapping or inventory of wetland boundaries and plant communities. ERTS-1 positive transparencies of Atlantic Coastal wetlands were enlarged to different scales and mapped using a variety of methods. Results of analysis indicate: (1) mapping of wetland boundaries and vegetative communities from imagery at a scale of 1:1,000,000 is impractical because small details are difficult to illustrate; (2) mapping to a scale of 1:250,000 is practical for defining land-water interface, upper wetland boundary, gross vegetative communities, and spoil disposal/dredge and fill operations; (3) 1:125,000 enlargements provide additional information on transition zones, smaller plant communities, and drainage or mosquito ditching. Overlays may be made directly from prints.

N73-19360*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A STUDY OF THE UTILIZATION OF ERTS-1 DATA FROM THE WABASH RIVER BASIN Bimonthly Progress Report, 1 Jan. - 28 Feb. 1973
D. A. Landgrebe, Principal Investigator 28 Feb. 1973 3 p
(Contract NAS5-21773)
(E73-10364; NASA-CR-131005) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Preliminary acreage estimates for corn, soybeans, and other cover types made from classification of ERTS-1 data compared well with those made by the U.S. Department of Agriculture. Registration of multiple frames of ERTS-1 CCT data over Lynn County, Texas and DeKalb County, Illinois was achieved to a high degree of accuracy. Spectral/temporal computer pattern recognition analysis was carried out for the first time using satellite data.

N73-19361*# Honeywell, Inc., St. Paul, Minn. Systems and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR PLANT SPECIES AND STRESS IDENTIFICATION (ERTS-A1) Progress Report
George D. Swanlund, Principal Investigator, Leonard Kirvida, and Greg R. Johnson 20 Mar. 1973 9 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-2186)
(E73-10365; NASA-CR-131006) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Automatic stratification of forested land from ERTS-1 data provides a valuable tool for resource management. The results are useful for wood product yield estimates, recreation and wildlife management, forest inventory, and forest condition monitoring. Automatic procedures based on both multispectral and spatial features are evaluated. With five classes, training and testing on the same samples, classification accuracy of 74 percent was achieved using the MSS multispectral features. When adding texture computed from 8 x 8 arrays, classification accuracy of 90 percent was obtained.

N73-19362*# Honeywell, Inc., St. Paul, Minn. Systems and Research Div.
AUTOMATIC PHOTOINTERPRETATION FOR PLANT SPECIES AND STRESS IDENTIFICATION (ERTS-A1) Progress Report
George D. Swanlund, Principal Investigator and Leonard Kirvida 20 Jan. 1973 3 p
(Contract NAS5-2186)
(E73-10366; NASA-CR-131007; PR-2) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-19363*# Delaware Univ., Newark. Coll. of Marine Studies.
IDENTIFICATION OF MARSH VEGETATION AND COASTAL LAND USE IN ERTS-1 IMAGERY
V. Klemas, Principal Investigator and D. Bartlett 21 Mar. 1973 14 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contracts NAS5-21837; N00014-69-A-0407)
(E73-10367; NASA-CR-131008) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-19364*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICABILITY OF ERTS-1 IMAGERY TO THE STUDY OF SUSPENDED SEDIMENT AND AQUATIC FRONTS

V. Klemas, Principal Investigator, R. Srna, W. Treasure, and M. Otley 20 Mar. 1973 17 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21837; Grant NSF GI-33369; NOAA-GH-109)
(E73-10368; NASA-CR-131009) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-19365*# Arizona Univ., Tucson.
A STUDY TO EXPLORE THE USE OF ORBITAL REMOTE SENSING TO DETERMINE NATIVE ARID PLANT DISTRIBUTION Progress Report, period ending 16 Feb. 1973
William G. McGinnies, Principal Investigator, Edward F. Haase, and H. Brad Musick, comp. 16 Feb. 1973 28 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21812)
(E73-10369; NASA-CR-131010) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. A theory has been developed of a method for determining the reflectivities of natural areas from ERTS-1 data. This method requires the following measurements: (1) ground truth reflectivity data from two different calibration areas; (2) radiance data from ERTS-1 MSS imagery for the same two calibration areas; and (3) radiance data from ERTS-1 MSS imagery for the area(s) in which reflectivity is to be determined. The method takes into account sun angle effects and atmospheric effects on the radiance seen by the space sensor. If certain assumptions are made, the ground truth data collection need not be simultaneous with the ERTS-1 overflight. The method allows the calculation of a conversion factor for converting ERTS-1 MSS radiance measurements of a given overflight to reflectivity values. This conversion factor can be used to determine the reflectivity of any area in the general vicinity of the calibration areas which has a relatively similar overlying atmosphere. This method, or some modification of it, may be useful in ERTS investigations which require the determination of spectral signatures of areas from spacecraft data.

N73-19366*# Earth Satellite Corp., Washington, D.C.
STUDY OF APPLICATION OF ERTS-A IMAGERY TO FRACTURE RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Progress Report, 1 Jan. - 1 Mar. 1973
Charles E. Wier, Frank J. Wobber, Principal Investigators, Orville R. Russell, and Roger Amato 16 Mar. 1973 10 p Prepared for Ind. Geol. Surv.
(Contract NAS5-21795)
(E73-10371; NASA-CR-131012) Avail: NTIS HC $3.00 CSCL 08I

The author has identified the following significant results. The utility of ERTS-1/high altitude aircraft imagery to detect underground mine hazards is strongly suggested. A 1:250,000 scale mined lands map of the Vincennes Quadrangle, Indiana has been prepared. This map is a prototype for a national mined lands inventory and will be distributed to State and Federal offices.

N73-19367*# Nebraska Univ., Lincoln.
PROPOSAL TO EVALUATE THE USE OF ERTS-A IMAGERY IN MAPPING AND MANAGING SOIL RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Progress Report, 1 Jan. - 28 Feb. 1973
James V. Drew, Principal Investigator 22 Mar. 1973 9 p
(Contract NAS5-21756)
(E73-10372; NASA-CR-131013) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Color composites generated from bands 4, 5, and 7 of MSS image 1061-16552 show that Aquic Haplustolls and Typic Haplaquolls can be separated from other subgroups present on Sand Hills rangeland. Since Aquic Haplustolls are suitable for establishment of center pivot irrigation systems, this provides one means of locating and assessing sites for the establishment of center pivot irrigation for irrigated pasture or other irrigated crops. This separation also provides for a rapid assessment of subirrigated land, much of which is used for harvest of hay. Subsequent estimates of hay production can then be made as ground truth establishes actual production levels.

N73-19368*# Environmental Research Inst. of Michigan, Ann Arbor.
PROCESSING OF ERTS-1 MULTISPECTRAL DATA OF INDIA
Fred J. Thomson, Principal Investigator, R. D. Sharma, and J. Morgenstern Feb. 1973 11 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21783)
(E73-10373; NASA-CR-131014; Rept-193301-4-L) Avail: NTIS CSCL 08F

There are no author-identified significant results in this report.

N73-19369*# Environmental Research and Technology, Inc., Lexington, Mass.
EVALUATE THE APPLICATION OF ERTS-A DATA FOR DETECTING AND MAPPING SEA ICE Bimonthly Progress Report, 31 Dec. 1972 - 28 Feb. 1973
James C. Barnes, Principal Investigator 21 Mar. 1973 7 p
(Contract NAS5-21802)
(E73-10374; NASA-CR-131015; ERT-P-408-4; BMPR-4) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Sea ice is detectable in all of the ERTS-1 MSS bands and can be distinguished from clouds through a number of interpretive keys. Considerable information on ice type can be derived from the ERTS-1 data. Ice types that appear to be identifiable include: ice floes of various categories, pack ice of various concentrations, ice belts, brash ice, rotten ice, fast ice, leads, fractures, cracks, puddles, thaw holes, and flooded ice. Although larger icebergs can be seen, it is difficult to distinguish them from ice floes. Ice features as small as the small floe of 20 to 100 m across can be detected, and the sizes of features somewhat smaller than 100 m can be measured from enlarged ERTS-1 prints. The multispectral analysis of the ERTS-1 MSS-7 bands provides much information on ice type and ice surface features that cannot be derived from a single spectral band. For example, thaw holes can often be distinguished from puddles because of their different appearances in the two bands. These surface features can be indicative of ice age. Furthermore, snow lines on glaciers can be reliably mapped through the joint use of the MSS-4 and 7 data.

N73-19370*# Army Engineer District, Los Angeles, Calif.
CALIFORNIA COAST NEARSHORE PROCESSES STUDY Progress Report, 1 Sep. 1972 - 28 Feb. 1973
Douglas M. Pirie and David D. Steller, Principal Investigators Mar. 1973 38 p refs Prepared in cooperation with Rockwell Intern. Corp. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(NASA Order S-70257-AG)
(E73-10375; NASA-CR-131016; ERTS-1-2-1) Avail: NTIS HC $4.00 CSCL 08H

The author has identified the following significant results. This report contains the techniques used for enhancing and analyzing nearshore processes from ERTS-1 and aircraft data. Four California nearshore sites are used as test cells including the San Francisco area, Monterey Bay, Santa Barbara Channel, and Los Angeles area. Techniques used for analyzing the test cells included direct photographic processing, computer compatible tape gain change enhancement, discrete point density analysis and plotting, and densitometer enhancement. Using these methods, it is possible to measure the seaward extent of the suspended sediment transport and to differentiate sediment levels within the individual sediment lobes. The movement of riverine discharged suspensates and coastal sediments by currents was an intricate part of the sediment transport analysis. The larger estuaries in the test cell areas were also studied for flushing characteristics.

N73-19371*# Mitre Corp., McLean, Va.
INVESTIGATION OF ENVIRONMENTAL INDICES FROM

THE EARTH RESOURCES TECHNOLOGY SATELLITE Interim Report, Aug. 1972 - Feb. 1973
Richard S. Greeley, Principal Investigator, E. L. Riley, S. Stryker, and E. A. Ward Feb. 1973 146 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21842)
(E73-10376; NASA-CR-131017) Avail: NTIS HC $9.50 CSCL 08B

The author has identified the following significant results. Land use, quality, and air quality trends are being deduced from both ERTS-1 MSS and computer compatible tapes. The data analysis plan and the preliminary data analysis phase were conducted in January 1973. Results from these two phases are: (1) Method of analysis has been selected and checked out. (2) Land use for two dates have been generated for one test site. (3) Water quality for one date has been produced partially. (4) Air quality for three has been produced and compared with ground truth. (5) One of the two DCP stations is in operation; the second station will be installed in March 1973. Land use classification exceeds pre-launch expectations. Water quality (turbidity) is not progressing as expected. Finally, mesoscale air quality results have shown correlation with NOAA/EPA turbidity network. If air quality correlations continue to show favorable results, a rapid means of global turbidity may be available from ERTS-1 MSS observations.

N73-19372*# Bureau of Land Management, Riverside, Calif.
PREDICT EPHEMERAL AND PERENNIAL RANGE QUANTITY AND QUALITY DURING NORMAL GRAZING SEASON Progress Report, 1 Jan. - 28 Feb. 1973
Gordon Bentley, Principal Investigator 1 Mar. 1973 3 p
(NASA Order S-70243-AG-1)
(E73-10377; NASA-CR-131018) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-19373*# Geological Survey, Hartford, Conn.
ESTUARINE AND COASTAL WATER DYNAMICS CONTROLLING SEDIMENT MOVEMENT AND PLUME DEVELOPMENT IN LONG ISLAND SOUND Progress Report, 1 Jan. - 28 Feb. 1973
Frederick H. Ruggles, Jr., Principal Investigator 28 Feb. 1973 2 p
(NASA Order S-70243-AG-3)
(E73-10378; NASA-CR-131019) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. As the Connecticut River flows into Long Island Sound, large plumes develop during the mixing of ocean and estuarine waters. Plumes were delineated for July 28, October 8, October 27, and December 2, 1972, by analyzing ERTS-1 imagery with the SRI Electronic Satellite Image Analysis Console (ESIAC). Because the chemical and physical composition of the plume and ocean water were not too different, the ESIAC was utilized to expand the scenes and subject the transparencies to varying combinations of viewing techniques to identify and delineate the plumes. Best results were obtained when band 5 transparencies were used. Indications are, when the scene being analyzed is predominantly in the first two steps of the gray scale, it is best to use the negative transparencies. When the analysis is being done above the first two steps of the gray scale, it is best to use the positive transparencies.

N73-19374*# Geological Survey, Tacoma, Wash.
EVALUATE ERTS IMAGERY FOR MAPPING AND DETECTION OF CHANGES OF SNOWCOVER ON LAND AND ON GLACIERS Progress Report, 1 Jan. - 28 Feb. 1973
Mark F. Meier, Principal Investigator 27 Feb. 1973 3 p
(NASA Order S-70243-AG-2)
(E73-10379; NASA-CR-131020) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. The percentage of snow cover area on specific drainage basins was measured from ERTS-1 imagery by video density slicing with a repeatability of 4 percent of the snow covered area. Data from ERTS-1 images of the melt season snow cover in the Thunder Creek drainage basin in the North Cascades were combined with existing hydrologic and meteorologic observations to enable calculations of the time distribution of the water stored in this mountain snowpack. Similar data could be used for frequent updating of expected inflow to reservoirs. Equivalent snowline altitudes were determined from area measurements. Snowline altitudes were also determined by combining enlarged ERTS-1 images with maps. ERTS-1 imagery was also successfully used to measure glacier accumulation area ratios for a small test basin.

N73-19375*# Geological Survey, Washington, D.C.
STUDY OF MULTISPECTRAL DATA, ERTS-A, NORTHWEST SAUDI ARABIA Progress Report, 1 Nov. - 31 Dec. 1972
Alfred J. Bodenlos, Principal Investigator 9 Feb. 1973 2 p
(NASA Order S-70243-AG)
(E73-10380; NASA-CR-131021) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-19376*# Geological Survey, Denver, Colo.
EVALUATION OF ERTS-1 IMAGERY FOR MAPPING QUATERNARY DEPOSITS AND LANDFORMS IN THE GREAT PLAINS AND MIDWEST Progress Report, 1 Jul. - 31 Dec. 1972
Roger B. Morrison, Principal Investigator and George R. Hallberg (Iowa Geol. Surv., Iowa City) 1 Jan. 1973 27 p
(NASA Order S-72043-AG)
(E73-10381; NASA-CR-131022) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. The main landform associations and larger landforms are readily identifiable on the better images and commonly the gross associations of surficial Quaternary deposits also can be differentiated, primarily by information on landforms and soils. Maps showing the Quaternary geologic-terrain units that can be differentiated from the ERTS-1 images are being prepared for 20-odd potential study areas in Illinois, Iowa, Missouri, Kansas, Nebraska, and South Dakota. Among the more distinct features are the major moraines and outwash channels of the last (Wisconsin) glaciation. Analysis of dissection/drainage patterns from the synoptic imagery is proving useful for detecting anomalies that may be caused by stream diversions and moraines of pre-Wisconsin glaciations, by variable loess deposition, by tectonism, and other factors. Numerous abandoned river valleys have been mapped. Trend-lines of several known pre-Wisconsin moraine systems have been identified in Iowa, Nebraska, and Kansas, and also several similar trend-lines, that may indicate previously unknown moraine systems of middle and possibly early Pleistocene age, have been found in Iowa and Missouri. The area inundated by a major flood in southwestern Iowa also has been delineated from ERTS-1 imagery.

N73-19377*# Geological Survey, Denver, Colo.
APPLICATION OF ERTS-1 IMAGERY TO DETECTING AND MAPPING MODERN EROSION FEATURES, AND TO MONITORING EROSIONAL CHANGES, IN SOUTHERN ARIZONA Progress Report, 15 Jul. 1972 - 31 Jan. 1973
Roger B. Morrison and Maurice E. Cooley 1 Feb. 1973 14 p
(NASA Order S-70243-AG)
(E73-10382; NASA-CR-131023) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. The red MSS band 5 gives the sharpest definition of modern arroyos. On the best images, modern arroyOs can be distinguished as narrow as 150 to 200 feet in reaches where their contrast with adjacent areas is only moderate, and as narrow as 60 to 75 feet where their contrast is high. Both the red and infrared bands show differences is soils and vegetation. In the late fall and winter imagery, band 7 generally is the most useful for mapping the areas of the more erodible soils. A map at 1:1,000,000 scale has been prepared that shows all the arroyos within the 17,000 square mile study area that have been identified from ERTS-1 images. Also, from U-2 color infrared airphotos, a 1:125,000 scale map has been made of a 50 mile reach along San Simon Wash, in southeastern Arizona. This map shows not only the arroyo channels and narrow flood plains that have developed since 1890, but also areas within a few miles of the wash that are severely guilled, severely sheet-eroded, and

moderately sheet-eroded. Two important effects of the third largest recorded flood of the upper Gila River also have been determined from the ERTS-1 images. The inundated area is best displayed on band 7, and the areas of severe sand/gravel erosion/deposition show best on band 5.

N73-19378*# Itek Corp., Lexington, Mass. Optical Systems Div.
AUTOMATED THEMATIC MAPPING AND CHANGE DETECTION OF ERTS-1 IMAGES, PART A
N. Gramenopoulos, Principal Investigator and F. J. Corbett Mar. 1973 42 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198
(Contract NAS5-21766)
(E73-10385; NASA-CR-131054; PFR-73-033) Avail: NTIS HC $4.25 CSCL 08B

The author has identified the following significant results. Automatic and accurate image processing techniques are essential to full utilization of ERTS-1 photography. In pursuit of this, terrain types in the ERTS-1 photography will be classified by spatial signatures. Diffraction patterns from selected ERTS-1 images have been developed optically and are being analyzed to identify unique signatures for various terrain types. Spatial signatures have been definitely identified for cultivated land and certain urban areas. A Fourier plane mask has been developed that greatly facilitates the analysis of the diffraction patterns.

N73-19379*# Itek Corp., Lexington, Mass. Optical Systems Div.
AUTOMATED THEMATIC MAPPING AND CHANGE DETECTION OF ERTS-A IMAGES Progress Report, 15 Jan. 1972 - 15 Mar. 1973
Nicholas Gramenopoulos, Principal Investigator Mar. 1973 4 p
(Contract NAS5-21766)
(E73-10386; NASA-CR-131064) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. This investigation is concerned with the development of automated interpretation techniques for the recognition and identification of earth resources. The resources will be identified by using both multispectral and spatial signatures. Ground truth data and aircraft underflight photography will be used to train the recognition algorithms. The data processed will be RBV and MSS images acquired by the ERTS-1 satellite, over six tests sites located in the vicinities of: Phoenix, Arizona; Weslaco, Texas; Cascade Mountains, Washington; New Orleans, Louisiana; Salt Lake, Utah; and Salton Sea, California. The processed data will be thematic maps of resources consisting of annotated and outlined images. The seasonal changes of hydrologic and agricultural resources will also be identified. The results are expected to be applicable to a future automatic system of resource inventory and management.

N73-19380*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
THE FORMATION AND ANALYSIS OF A 5 DEG EQUAL AREA BLOCK TERRESTRIAL GRAVITY FIELD
Richard H. Rapp Jun. 1972 37 p refs
(Grant NGR-36-008-161; SURF Proj. 3210; OSURF Proj. 3210)
(NASA-CR-130176; Rept-178) Avail: NTIS HC $4.00 CSCL 08N

A set of 23,355 1 degree x 1 degree mean free air anomalies were used to predict a set of 5 degree equal area anomalies and their standard errors. Using the 1 degree data incorporating geophysically predicted values of ACIC, 1283 5 degree blocks were computed. Excluding the geophysically predicted anomalies 1249 blocks were computed. The 1 degree data were also used to compute covariance functions and the equatorial gravity and flattening implied by this data. The predicted anomalies were supplemented by model anomalies to form a complete 1654 global anomaly field. These data were used in a weighted least squares to determine potential coefficients to degree 15, and in a summation type formulation to determine potential coefficients to degree 25. These potential coefficients sets are compared to recent satellite determinations. Author

N73-19381# Joint Publications Research Service, Arlington, Va.
AERIAL PHOTOGRAPHIC AND ELECTROMAGNETIC DETERMINATION OF THE SEA SURFACE AND ITS CONDUCTIVITY
2 Mar. 1973 25 p refs Transl. into ENGLISH from Okeanologiya (Moscow), no. 6 1972
(JPRS-58370) Avail: NTIS HC $3.25

An article on the relationship between wave parameters and the spatial spectrum of aerial photographs and radar images of the sea surface is presented. The use of an electromagnetic method for measuring the conductivity of the sea surface layer is described. For individual titles, see N73-19382 through N73-19383.

N73-19382 Joint Publications Research Service, Arlington, Va.
ELECTROMAGNETIC METHOD OF MEASUREMENT OF THE SEA SURFACE LAYER CONDUCTIVITY
A. G. Kravtsov *In its* Aerial Phot. and Electromagnetic Determination of the Sea Surface and its Conductivity 2 Mar. 1973 p 1-6 refs (For availability see N73-19381 10-13)

A method of determining the conductivity in the surface layer of the sea according to the recording of the field of remote transmitters of a common time system operating in the superlong-wave range, is considered. The results of an experiment in the littoral zone of the Black Sea are given. The conclusion is made that the method is applicable up to depths of several tens of meters in operation from a trestle, a buoy, and a towed device. The range of depths may be expanded by means of a transition to the recording of low-frequency fields created by atmospheric noises, but at great depths it is feasible to use an autonomous source of low-frequency oscillations. Author

N73-19383 Joint Publications Research Service, Arlington, Va.
THE RELATIONSHIP BETWEEN WAVE PARAMETERS AND THE SPATIAL SPECTRUM OF AERIAL PHOTOGRAPHS AND RADAR IMAGES OF THE SEA SURFACE
I. M. Bondarenko, A. A. Zagorodnikov, V. S. Loshchilov, and K. B. Chelyshev *In its* Aerial Phot. and Electromagnetic Determination of the Sea Surface and its Conductivity 2 Mar. 1973 p 7-22 refs (For availability see N73-19381 10-13)

The derivation of algorithms correlating the spectra of wave conditions with two dimensional spectra of aerial photographs and radar images of the surface of the sea is given. It is demonstrated that the two dimensional spectra of aerial photographs and radar images of this surface contain information concerning the various characteristics of sea waves. Based on this information it is possible to calculate such complex characteristics as one dimensional and two dimensional spectra. Author

N73-19384*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SOLUTION OF THE GEODETIC BOUNDARY VALUE PROBLEM TO ORDER e3
R. S. Mather Jan. 1973 133 p refs Submitted for publication
(NASA-TM-X-66199; X-592-73-11) Avail: NTIS HC $8.75 CSCL 08G

A solution is obtained for the geodetic boundary value problem which defines height anomalies to + or - 5 cm, if the earth were rigid. The solution takes into account the existence of the earth's topography, together with its ellipsoidal shape and atmosphere. A relation is also established between the commonly used solution of Stokes and a development correct to order e cubed. The data requirements call for a complete definition of gravity anomalies at the surface of the earth and a knowledge of elevation characteristics at all points exterior to the geoid. In addition, spherical harmonic representations must be based on geocentric rather than geodetic latitudes. Author

N73-19385*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS-4 BACKSCATTER ULTRAVIOLET (BUV) ATMOSPHERIC OZONE EXPERIMENT TWO YEARS OPERATION
Donald F. Heath, Carlton L. Mateer (Atmospheric Environment Serv., Downsview, Ontario), and Arlin J. Krueger Feb. 1973 28 p refs Submitted for publication

(NASA-TM-X-66204; X-651-73-64) Avail: NTIS HC $3.50 CSCL 04A

The Backscatter Ultraviolet (BUV) experiment aboard the Nimbus-4 satellite is discussed. This double monochromator experiment measures ultraviolet terrestrial radiance at 12 discrete wavelengths between 2550 A and 3400 A. Approximately 100 scans covering a 230 kilometer square are made between terminator crossings on the daylight side of the earth. A colinear photometer channel with the same field of view is used to derive the Lambert reflectivity of the lower boundary of the scattering atmosphere. The extraterrestrial solar irradiance is measured at the northern terminator. The instrument has currently produced almost three years of nearly continuous data which are being used to infer the high-level ozone distribution and total ozone on a global basis. The high-level ozone data have been verified by independent coincident rocket ozone soundings, and the total ozone values show good agreement with Dobson spectrophotometer determinations as well as those made with the Infrared Interferometer Spectrometer also on Nimbus-4. Author

N73-19386*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE INFERENCE OF ATMOSPHERIC OZONE USING SATELLITE NADIR MEASUREMENTS IN THE 1042/cm BAND

James M. Russell, III and S. Roland Drayson (Mich. Univ.) Washington Mar. 1973 55 p refs

(NASA-TR-R-399; L-8635) Avail: NTIS HC $3.00 CSCL 04A

A description and detailed analysis of a technique for inferring atmospheric ozone information from satellite nadir measurements in the 1042 cm band are presented. A method is formulated for computing the emission from the lower boundary under the satellite which circumvents the difficult analytical problems caused by the presence of atmospheric clouds and the watervapor continuum absorption. The inversion equations are expanded in terms of the eigenvectors and eigenvalues of a least-squares-solution matrix, and an analysis is performed to determine the information content of the radiance measurements. Under favorable conditions there are only two pieces of independent information available from the measurements: (1) the total ozone and (2) the altitude of the primary maximum in the ozone profile. Author

N73-19387*# Texas Univ., Houston. Inst. of Environmental Health.

APPLICATION OF SELECTED METHODS OF REMOTE SENSING FOR DETECTING CARBONACEOUS WATER POLLUTION

Ernst M. Davis and W. J. Fosbury Dec. 1972 181 p refs

(Contract NAS9-12040)

(NASA-CR-128824) Avail: NTIS HC $11.25 CSCL 08H

The use of aerial photography to determine the nature and extent of water pollution from carbonaceous materials is discussed. Flights were conducted over the Galveston Bay estuarine complex. Ground truth data were developed from field sampling of the waters in a region near the Houston Ship Channel. Tests conducted in the field were those for the following physical and chemical factors: (1) ph, (2) dissolved oxygen, (3) temperature, and (4) light penetration. Laboratory analyses to determine various properties of the water are described and the types of instruments used are identified. Results of the analyses are presented as charts and graphs. Author

N73-19388*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN ADAPTIVE TECHNIQUE FOR ESTIMATING THE ATMOSPHERIC DENSITY PROFILE DURING THE AE MISSION

P. Argentiero Feb. 1973 18 p refs

(NASA-TM-X-66202; X-591-73-52) Avail: NTIS HC $3.00 CSCL 04A

A technique is presented for processing accelerometer data obtained during the AE missions in order to estimate the atmospheric density profile. A minimum variance, adaptive filter is utilized. The trajectory of the probe and probe parameters are in a consider mode where their estimates are unimproved but their associated uncertainties are permitted an impact on filter behavior. Simulations indicate that the technique is effective in estimating a density profile to within a few percentage points. Author

N73-19389*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THEORY OF THE PHASE ANOMALY IN THE THERMOSPHERE

H. G. Mayr, I. Harris, and H. Volland Feb. 1973 34 p refs

(NASA-TM-X-66206; X-621-73-71) Avail: NTIS HC $3.75 CSCL 04A

The temperature-density phase anomaly is discussed on the basis of a quasi-three-dimensional model in which the thermosphere dynamics (including energy advection and diffusion associated with wind circulation) is considered in a self consistent form. Included in this analysis are the first three harmonics with nonlinear coupling between diurnal and semi-diurnal tides. Author

N73-19390# Illinois Univ., Urbana. Aeronomy Lab.

INVESTIGATION OF THE IONOSPHERIC RESPONSE TO THE SOLAR ECLIPSE OF 7 MARCH 1970 BY THE THOMSON SCATTER RADAR TECHNIQUE AT THE MILLSTONE HILL IONOSPHERE OBSERVATORY

W. L. Oliver, Jr. and S. A. Bowhill 1 Feb. 1973 182 p refs

(Grant NSF GA-27295)

(UILU-ENG-73-2501; Aeronomy-51) Avail: NTIS HC $11.25

The Thomson-scatter radar data obtained on the day of the solar eclipse of 7 March 1970 are reported and analyzed. Values of electron density, electron and ion temperature, and ion composition are obtained throughout the eclipse. The ionospheric response to the eclipse is analyzed in terms of ion chemical processes and the distribution of solar radiations emanating from the solar atmosphere. Residual ionospheric densities observed at eclipse maximum phase are interpreted in terms of solar coronal emissions and the differential absorption of solar emissions in the ionosphere. The observed ion composition is used to derive values of important ion-neutral reaction rate coefficients. The temperature data are interpreted in terms of the ionospheric response to the large magnetic storm in progress during the eclipse. Independent ion-composition data obtained by rocket at Wallops Island during the eclipse are used to determine nitric oxide concentrations. Author

N73-19391*# New York Univ., N.Y. Dept. of Meteorology and Oceanology.

TRANSEQUATORIAL EFFECTS OF SEA SURFACE TEMPERATURE ANOMALIES IN A GLOBAL GENERAL CIRCULATION MODEL

Jerome Spar Sep. 1972 32 p refs

(Grant NGR-33-016-174)

(NASA-CR-130179; GSL-TR-72-7) Avail: NTIS HC $3.75 CSCL 04A

The global response of the atmosphere to a persistent anomalous pool of warm sea surface temperatures in the extratropical Pacific Ocean is examined in terms of the meridional pole-to-pole profile of the zonally-averaged 600 mb surface for periods up to 90 days. Following an initial hydrostatic inflation of the isobaric surface in the latitude of the warm pool, effects spread poleward within the hemisphere, then begin to appear after about two to three weeks in high latitudes of the opposite hemisphere, but with little or no response in the tropics. The same sea temperature anomaly field generates a stronger response in winter than in summer, and a very different reaction when located in the Southern Hemisphere than when in the Northern Hemisphere. Author

N73-19392*# South Dakota State Univ., Brookings. Remote Sensing Inst.

REFLECTANCE MEASUREMENTS FOR THE DETECTION AND MAPPING OF SOIL LIMITATIONS Interim Technical Report

L. A. Benson and C. J. Frazee Mar. 1973 93 p refs Original contains color illustrations

(Grant NGL-42-003-007)

(NASA-CR-131110; SDSU-RSI-73-04) Avail: NTIS HC $6.75 CSCL 08M

During 1971 and 1972 research was conducted on two fallow fields in the proposed Oahe Irrigation Project to investigate

the relationship between the tonal variations observed on aerial photographs and the principal soil limitations of the area. A grid sampling procedure was used to collected detailed field data during the 1972 growing season. The field data was compared to imagery collected on May 14, 1971 at 3050 meters altitude. The imagery and field data were initially evaluated by a visual analysis. Correlation and regression analysis revealed a highly significant correlation between the digitized color infrared film data and soil properties such as organic matter content, color, depth to carbonates, bulk density and reflectivity. Computer classification of the multiemulsion film data resulted in maps delineating the areas containing claypan and erosion limitations. Reflectance data from the red spectral band provided the best results. Author

N73-19393# Champlain Technology, Inc., West Palm Beach, Fla.
EVALUATION OF THE OPERATIONAL, DESIGN AND SUPPORT ASPECTS OF CARTOGRAPHY FOR USE IN CIVIL AREA NAVIGATION MAP DISPLAYS. VOLUME 1: TECHNICAL Final Report, Jul. 1971 - Apr. 1972
Jul. 1972 250 p refs Prepared in cooperation with Anacapa Sci., Inc. 2 Vol.
(Contract DOT-FA71WA-2642)
(FAA-RD-72-129-Vol-1) Avail: NTIS HC $14.50

An evaluation of the operational aspects of cartography for use in civil area navigation operations was undertaken through an analysis of the 1975-80 U.S domestic airspace environment. Supporting data for this analysis was collected through a series of observation flights in map display, area navigation and conventional VOR navigation-equipped aircraft. Eight potential roles for map displays are discussed. Through a series of ten simulated flights using a variety of conventional, area navigation and map display equipment, the cartographic information elements necessary to operate in the 1975-80 are identified. As an adjunct to the operational analyses, the cartographic and display variables which affect the utility of a map display are analyzed. Six major issues concerning the cartographic support of map displays are identified and discussed. Author

N73-19394# Champlain Technology, Inc., West Palm Beach, Fla.
EVALUATION OF THE OPERATIONAL, DESIGN AND SUPPORT ASPECTS OF CARTOGRAPHY FOR USE IN CIVIL AREA NAVIGATION MAP DISPLAYS. VOLUME 2: APPENDICES Final Report, Jul. 1971 - Apr. 1972
Jul. 1972 274 p Prepared in cooperation with Anacapa Sci., Inc. 2 Vol.
(Contract DOT-FA71WA-2642)
(FAA-RD-72-129-Vol-2) Avail: NTIS HC $15.75
For abstract, see N73-19393

N73-19395*# South Dakota State Univ., Brookings. Remote Sensing Inst.
REMOTE SENSING OF PHYSIOGRAPHIC SOIL UNITS OF BENNETT COUNTY, SOUTH DAKOTA
C. J. Frazee, J. L. Gropper, and F. C. Westin Feb. 1973 46 p refs
(Grant NGL-42-003-007)
(NASA-CR-131229; SDSU-RSI-73-02) Avail: NTIS HC $4.50 CSCL 08M

A study was conducted in Bennett County, South Dakota, to establish a rangeland test site for evaluating the usefulness of ERTS data for mapping soil resources in rangeland areas. Photographic imagery obtained in October, 1970, was analyzed to determine which type of imagery is best for mapping drainage and land use patterns. Imagery of scales ranging from 1:1,000,000 to 1:20,000 was used to delineate soil-vegetative physiographic units. The photo characteristics used to define physiographic units were texture, drainage pattern, tone pattern, land use pattern and tone. These units will be used as test data for evaluating ERTS data. The physiographic units were categorized into a land classification system. The various categories which were delineated at the different scales of imagery were designed to be useful for different levels of land use planning. The land systems are adequate only for planning of large areas for general uses. The lowest category separated was the facet. The facets have a definite soil composition and represent different soil landscapes. These units are thought to be useful for providing natural resource information needed for local planning. Author

N73-19396*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH RESOURCES TECHNOLOGY SATELLITE-1 SYMPOSIUM PROCEEDINGS, 29 SEPTEMBER 1972
William A. Finch, Jr., comp. Jan. 1973 171 p refs Symp. held at Greenbelt, Md. Original contains color illustrations
(NASA-TM-X-66193; X-650-73-10) Avail: NTIS HC $10.75 CSCL 08E

Papers presented to the symposium on ERTS-1 are reported. The performance of sensors and systems, and applications of ERTS-1 imagery are discussed. F.O.S.

N73-19397# Los Alamos Scientific Lab., N.Mex.
SUBSTORM PHENOMENA IN THE DISTANT MAGNETOSPHERE
E. W. Hones, Jr. 1972 28 p refs Presented at Solar Terrest. Relations Conf., Calgary, Alberta, 28 Aug. 1972
(LA-DC-72-1165; Conf-720838-1) Avail: NTIS

The substorm-related thinning and thickening of the magnetotail plasma sheet observed by the Vela satellites are described and illustrated by examples. Magnetic field measurements made by other satellites in the tail indicate that the plasma sheet at those greater distances undergoes the same type of substorm variations. These observations, together with plasma flow measurements made by the Vela satellites, support a substorm model for the plasma sheet in which the traditional substorm breakup features observed at the earth signal the onset of magnetic field-line merging at some distance from the earth near, the midnight sector of the tail. Author (NSA)

N73-19398# Alaska Univ., College. Geophysical Inst.
STUDY OF MAGNETOSPHERIC SUBSTORMS IN CONJUNCTION WITH THE VELA SATELLITE DATA Annual Progress Report
S. Akasofu Sep. 1972 22 p refs
(Contract AT(45-1)-2229)
(RLO-2229-T-5-2) Avail: NTIS

The progress made on the study of the morphology of complex behaviors of the plasma sheet during magnetospheric substorms and their causes is reported. Data are presented on possible outflow from the magnetotail into the magnetosheath during magnetospheric substorms, low energy protons in the plasma sheet, plasma flow in the plasma sheet during magnetospheric substorms, simultaneous observations of magnetospheric substorms by the synchronous satellite ATS-5 and Vela satellites, and the structure of the plasma sheet. The results of the Feb. 1971 airborne auroral expedition to investigate the relation between the onset of the thinning of the plasma sheet and the onset time of substorms are briefly discussed. NSA

N73-19399# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
TRANSPORT PROCESSES AND TRACE CONSTITUENTS IN THE STRATOSPHERE Progress Report, 1 May 1972 - 20 Nov. 1972
Derek M. Cunnold 20 Sep. 1972 49 p
(Contract AT(11-1)-2249)
(COO-2249-1)

Trace constituents and transport processes are studied in the stratosphere by climatological data analysis and numerical models. The effects of trace constituents on heating rates are also examined. Details are given of photochemical models and procedures for solving spherical quasi-geostrophic equations and nondimensional finite difference equations. A choice of vertical levels and associated mean state parameters are included.
E.H.W.

N73-19400# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
SPECTRA OF IONOSPHERIC PHOTOELECTRONS AND THEIR TRANSPORT FROM THE CONJUGATE IONOSPHERE
Y. I. Galperin, M. Dymek, I. Kutiev, T. M. Mulyarchik, K. B. Serafimov, F. K. Shuiskaya, and A. Wernik 1972 36 p refs
(PR-107) Avail: NTIS HC $4.00

Energy spectra of ionospheric photoelectrons were measured in the range 30 to 150 eV on Cosmos 348 in the summer of 1970. The averaged spectra are of double exponential shape. The energy at which the change in slope occurs is relatively stable within experimental error. Comparisons are made between the spectra of the upward going photoelectrons dissipating from the lower ionosphere under the satellite and the spectra of downgoing photoelectrons which were transported from the conjugate ionosphere. For the conjugate photoelectrons the spectrum shape is changed by a significant diminution of the lower energy electrons in the measured range. Due to the existence of the characteristic change of slope on the photoelectron energy spectrum it is possible to measure the electrostatic potential difference between the two ends of the magnetic force tube in the middle F-region. Author (ESRO)

N73-19401# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
INFLUENCE OF THE GEOMAGNETIC FIELD INCLINATION ON REFLECTION OF THE GUIDED HYDROMAGNETIC WAVES FROM THE IONOSPHERE
L. L. Vanyan and A. A. Kozhevnikov 1972 14 p refs
(PR-119) Avail: NTIS HC $3.00

To study the properties of geomagnetic pulsations the hypothesis that they are generated by an oscillating electric dipole normal to the geomagnetic field and 4 to 8 earth radii from the ionosphere is put forward. The magnetosphere is represented as a homogeneous cold plasma which is magnetized by a constant, homogeneous field. If the plasma is collisionless then the dipole generates two opposite phase currents, which are considered as guided waves. The structure and propagation of these guided magnetohydrodynamic waves inclined to the ionosphere are discussed. ESRO

N73-19402# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
THREE-DIMENSIONAL CURRENT SYSTEM OF SUBSTORM CONSIDERED WITH AN INTERACTION OF CONJUGATE IONOSPHERES
L. L. Vanyan and A. S. Debabov 1972 8 p refs
(PR-122) Avail: NTIS HC $3.00

Field-aligned current systems produced by both azimuthal and radial magnetospheric sources are considerd. Closing of currents takes place in northern and southern high latitudinal ionospheres possessing different gyrotropic conductivities with conductivity distortions of elliptical configuration. Field-aligned currents and magnetic effect of current systems are evaluated. Author (ESRO)

N73-19403# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
DIRECT MEASUREMENTS OF PLASMA CONVECTION IN THE UPPER IONOSPHERE
Y. I. Galperin and V. N. Ponomarev 1972 18 p refs
(PR-130) Avail: NTIS HC $3.00

Results of direct measurements of the convection velocity transversal component in the horizontal plane for the polar upper ionosphere, obtained with the Cosmos 184 satellite during the moderate magnetic disturbance of 4th November 1967, are presented. The asymmetry of 1 cm flow around the satellite was measured by means of a differential ionic sensor oriented relative to the satellite velocity vector. Data on the plasma convection patterns are compared to that obtained by barium cloud drift observations. ESRO

N73-19404# Naval Oceanographic Office, Washington, D.C.
ENVIRONMENTAL-ACOUSTICS ATLAS OF THE CARIBBEAN SEA AND GULF OF MEXICO. VOLUME 2: MARINE ENVIRONMENT
Aug. 1972 281 p refs
(AD-752494; NOO-SP-189-Vol-2) Avail: NTIS CSCL 08/10

The atlas, consisting of two volumes and a separately bound appendix, summarizes available acoustic and environmental data in the Caribbean Sea, Gulf of Mexico and in their Atlantic Ocean approaches between 10 degrees N and 30 degrees N and west of approximately 56 degrees W. This volume includes data on geomagnetic background, subbottom structures, wind, waves, rainfall, and currents. Author (GRA)

N73-19405# SACLANT ASW Research Center, La Spezia (Italy).
THE FINE STRUCTURE OF THE OCEAN: A REVIEW
John P. Bethell 15 Dec. 1972 33 p refs
(AD-753445; SACLANTCEN-TM-184) Avail: NTIS CSCL 08/10

Underwater acoustical measurements during World War II revealed small-scale inhomogeneities in the ocean attributed to small random scatterers. Not until 1963 did vertical sound-speed profiling reveal the layered nature of the phenomenon. Observations in many parts of the world have revealed the common occurrence of layered regions at many depths. The layers are quasi-homogeneous and range in thickness from a few centimeters to tens, or sometimes hundreds, of meters. The formation of the layers is attributed to one or more of three broad processes: (a) horizontal transport, (b) vertical transport by thermohaline diffusion, and (c) vertical transport by dynamic instability. The details are still subjects of discussion and various explanations are reviewed. GRA

N73-19406# Naval Postgraduate School, Monterey, Calif.
SPECTRA OF TURBULENT FLUCTUATIONS OVER OCEAN WAVES M.S. Thesis
Glenn Stevenson Bingham Sep. 1972 63 p refs
(AD-753624) Avail: NTIS CSCL 08/3

Spectral analyses are performed on turbulence data obtained over natural ocean waves during BOMEX. Results are obtained for variance and co-variance spectra, phase and coherence relationships, and amplitude ratios. Peaks in the horizontal and vertical velocity spectra are observed to correspond to the frequency of the wave spectra peaks. Phase relationships tend to obey predictions of potential flow theory in regions of the wave spectra peaks. However, the wave related motion contributes to the momentum transfer which is not predicted by potential flow theory. The ratio of the wave induced disturbance to the sea surface displacement is used to locate the wave spectra frequency for which the level of measurement is a critical level. Author (GRA)

N73-19407# Pacific Missile Range, Point Mugu, Calif.
TIDAL AND LUNAR DATA FOR POINT MUGU, SAN NICHOLAS ISLAND, AND THE BARKING SANDS AREA DURING 1973
Robert de Violini 27 Nov. 1972 61 p ref
(AD-752892; PMR-TP-72-7) Avail: NTIS CSCL 08/3

Basic lunar and tidal data for Point Mugu, San Nicolas Island, and the Barking Sands area during 1973 are provided. The data presented are times of moonrise and moonset, and times of lunar phases. Author (GRA)

N73-19408# Wisconsin Univ., Madison. Geophysical and Polar Research Center.
UPPER MANTLE Q AND TRANSMISSION STUDIES USING LASA AND WWSS DATA Final Report
Joseph F. Gettrust and Robert P. Meyer 10 Oct. 1972 82 p refs
(Contract F44620-68-C-0087; AF Proj. 8652)
(AD-753110; AFOSR-72-2362TR) Avail: NTIS CSCL 08/11

Studies related to the crust and upper-mantle structure beneath the Montana LASA support the idea that the source of seismic time delays at the array includes the upper mantle. A study of the crustal transfer-ratio at LASA shows the complexity of ratio spectra for models concerned principally with the crust are not complex enough to fit actual data from the array. Thus, structure in the upper-mantle is suggested. A study of the earth's isostatic response to a concentrated load, which makes no a priori assumptions concerning the mechanism of compensation, suggests compensation is more complicated than the Heiskanen, Pratt, or Airy mechanisms would suggest and extends well into the upper mantle. A long-range seismic refraction study along the axis of the Rocky Mountains supports a double M-discontinuity. Author (GRA)

N73-19409# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIGHT IN THE SEA
Yu. E. Ochakovskii, O. V. Kopelevich, and V. I. Voitov 30 Aug. 1972 210 p refs Transl. into ENGLISH from unidentified Russian mono., Moscow, 1970 p 1-175

AD-753029; FTD-HT-23-105-72) Avail: NTIS CSCL 08/10

The book deals with a relatively new division of science-hydrooptics, which studies the penetration and transmission of light in the sea. The authors emphasize the importance of knowing the physical laws determining these processes, especially in connection with the solution of such an important and timely problem as the exploitation of the resources of the World Ocean. The book discusses the transmission of light in the sea, how the optical properties of the various seas and oceans differ from one another, how light originates in the sea, and the significance of marine optics for marine biology and other marine sciences. The major divisions of the book are: The Birth of Hydrooptics, The Absorption and Scattering of Light in Sea Water, Sea Transparency, Sunlight in the Sea, Why Different Seas are Different in Color, Why Vision is Poorer in Water than in Air, Marine Optics and Underwater Photography, Light and Life in the Sea, and the Conclusion. Author (GRA)

N73-19410# Boston Univ., Mass. Dept. of Astronomy.

IONOSPHERIC AND SOLAR RADIO STUDIES FOR DISTURBED CONDITIONS Final Report, 1 Sep. 1970 - 31 Aug. 1972

Michael D. Papagiannis and Michael Mendillo Nov. 1972 44 p refs

(Contract F19628-71-C-0027; AF Proj. 4643)

(AD-754252; AFCRL-72-0670) Avail: NTIS CSCL 04/1

The purpose of this contract is to study the atmosphere, the ionosphere and the magnetosphere of the earth under disturbed conditions produced by enhanced solar activity. It also includes, therefore, the study of solar activity in the different regions of the spectrum with special emphasis in the radio domain. Data obtained with ground-based radio telescopes and satellites, together with related information concerning ionospheric parameters, magnetic field intensities, optical solar observations, etc., were used in the different projects under investigation, all of which have the common aim to gain a better understanding of the terrestrial disturbances caused by the active sun.

Author (GRA)

N73-19411# Ballistic Research Labs., Aberdeen Proving Ground, Md.

ASSOCIATION, SWITCHING, AND REARRANGEMENT FOR POSITIVELY CHARGED CLUSTER IONS IN THE UPPER ATMOSPHERE. 1: QUALITATIVE DESCRIPTION

Franklin E. Niles and Joseph M. Heimerl Aug. 1972 37 p refs

(DA Proj. 1T0-61102-B-53A)

(AD-753940; BRL-1595) Avail: NTIS CSCL 04/1

The hydrated protons observed in the earth's upper atmosphere are thought to be formed by a series of reactions with either NO(-) or O2(-) as the principal precursor ion. The reactions involve positive ion-neutral association, switching of a neutral molecule clustered to the positive ion with another neutral molecule, and the creation of a new positive ion through ion-neutral rearrangement. Rate coefficients measured in various laboratories are given. Steric representations for the cluster ions are presented and used to describe possible mechanisms for the reactions. The manner in which either HO2 or OH, but not H, can react with NO(-)(H2O), to provide a possible fast path to H(-)(H2O) is discussed. Author (GRA)

N73-19412# Utah State Univ., Logan. Logan Space Science Lab.

ROCKETBORN MEASUREMENTS OF IONOSPHERIC DISTURBANCES Final Report, 1 Jul. 1970 - 31 Mar. 1972

Kay D. Baker 1 Oct. 1972 42 p refs Sponsored in part by Defense Nucl. Agency

(Contract F19628-70-C-0302; AF Proj. 7663)

(AD-754244; AFCRL-72-0601) Avail: NTIS CSCL 04/1

During the period 1 July 1970 to 31 March 1972 a total of 12 rocketborne payloads were used from various launch sites to investigate ionospheric disturbances. The payloads were instrumented to measure a wide scope of ionospheric parameters which included ionizing sources and effects of these upon the atmosphere. The report is a summary of each research program involved and a complete compilation of references and abstracts pertinent to this research contract. Author (GRA)

N73-19413# Boston Coll., Chestnut Hill, Mass.

MAGNETIC CALIBRATION AND PAYLOAD DETAILS FOR TOMAHAWK (A08.112-1) SOUNDING ROCKET

Raymond P. Pichulo 29 Sep. 1972 33 p refs

(AD-754246; Scientific-2; AFCRL-72-0603) Avail: NTIS CSCL 04/1

The report contains a detailed description of the fabrication and calibration of a Tomahawk sounding rocket payload. The payload was used to make magnetic field measurements in the ionosphere. It was launched from Fort Churchill, Manitoba, Canada, on 1 May 1972. Author (GRA)

N73-19414# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

A SIMPLE EXACT SOLUTION FOR THE MOTION OF THE ATMOSPHERE ABOUT THE ROTATING EARTH AND APPLICATION TO THE ROTATION OF THE ATMOSPHERE

Harry E. Moses 13 Oct. 1972 16 p refs

(AD-754248; AFCRL-ERP-418; AFCRL-72-0609) Avail: NTIS CSCL 04/1

A simple solution for the steady-state motion of the atmosphere about the rotating earth is given. The coriolis and centrifugal forces are taken into account exactly, as are the non-linearities of the equations of motion of the fluid. It is assumed that the wind has east-west components only, is independent of the longitude, and has the simplest possible dependence on the latitude. The resulting wind is an analogue of the constant wind in a flat, non-rotating space. A special case is that for which the velocity is identically zero at the earth's surface. This solution is a possible model for superrotation. A numerical comparison with experiment is in a later paper.

Author (GRA)

N73-19415# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.

COORDINATED MEASUREMENTS OF IONOSPHERIC IRREGULARITIES: DIGITAL PHOTOMETER DESIGN AND DEVELOPMENT

Robert D. Sears 20 Oct. 1972 36 p refs

(Contract DASA01-71-C-0158)

(AD-754436; LMSC-D311213; DNA-2997T) Avail: NTIS CSCL 04/1

A photometer system has been designed which incorporates the concepts of modularity and fully digitized control and data recording electronics. Modularity allows field substitution of background subtraction techniques, filter choice, and choice of input optical configuration. Novel features include a trichroic filtering module which allows simultaneous monitoring of auroral or airglow emission intensities in three spectral regions with the same field of view and input optics. Also described is a novel three beam adaptation which allows monitoring of the emission intensity from three closely spaced regions in the upper atmosphere in the same spectral region. The digital counting and control electronics described are compatible with NIMBIN plug in modules and allow expansion of the system to many photon counting channels as well as ready interfacing with other data sources. Author (GRA)

N73-19416# Dikewood Corp., Albuquerque, N.Mex.

STUDY OF POLAR CAP UPPER ATMOSPHERIC PHENOMENOLOGY Final Report, 1 Apr. 1970 - 30 Sep. 1972

June G. Brenton 27 Oct. 1972 39 p refs

(Contract F19628-70-C-0212; AF Proj. 7661)

(AD-754250; DC-FR-1212; AFCRL-72-0649) Avail: NTIS CSCL 04/1

A study of polar cap upper atmospheric phenomenology was conducted to provide background information on the state of polar cap research and to investigate some global effects of polar cap disturbances. The results of a survey and evaluation of the literature on polar cap research, mainly from the International Geophysical Year through 1971, were documented in an extensive bibliography of titles with section summaries of the work referenced and in a four-volume bibliography with abstracts. Possible effects of polar cap disturbances were found in wave-like disturbances of the 5577 A emission intensity observed from the AFCRL Airglow Station at Sacramento Peak, New Mexico, on ten nights between December 1956 and June 1962.

Author (GRA)

N73-19417# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF RADIATION PROCESSES IN THE ATMOSPHERE
28 Sep. 1972 131 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 252, 1970 p 3-126
(AD-753975; FSTC-HT-23-129-73) Avail: NTIS CSCL 04/1

The report discusses angular distribution of outgoing shortwave radiation intensity in the event of continuous cloud cover. Construction and operation of a laboratory set-up for measurement of radiation capacity of water in the centimeter range are discussed. The structure and operation of an airborne thermal surveyor and some results of its use for investigation of radiation from underlying surfaces, are discussed. Possibilities of using infrared technology in discovering forest fires from aircraft are discussed. A comparison is made and discussed of measured and calculated values of outgoing longwave radiation for different seasons of the year. Methods and results of calculations of outgoing radiation in the 3-18 micrometer spectral range for certain regions of the Soviet Union are discussed. Author (GRA)

N73-19418# Army Foreign Science and Technology Center, Charlottesville, Va.
PROPAGATION OF VISIBLE AND INFRARED WAVES IN THE ATMOSPHERE
V. E. Zuev 4 Nov. 1972 552 p refs Transl. into ENGLISH from Sovetskoe Radio (Moscow), 1970
(AD-753974; FSTC-HT-23-2475-72) Avail: NTIS CSCL 04/1

The monograph generalizes the main results of theoretical and experimental studies which examine various aspects of the problem of the propagation of visible and infrared waves in the atmosphere. The first two parts examine problems dealing with the absorption and dissipation of both monochromatic and non-monochromatic radiation under various meteorological conditions, distances and directions in which the radiation is propagated. The third part describes the laws which govern the spatial propagation of bounded radiation beams from heat sources and lasers in the atmosphere: the structure of the beam in various scattering media, the effect of atmospheric turbulence on the beam parameters and nonlinear effects which accompany the propagations of powerful radiation in the atmosphere. Author (GRA)

N73-19578* Scientific Translation Service, Santa Barbara, Calif.
THE INFLUENCE OF THE DAY-NIGHT EFFECT IN THE DISTRIBUTION OF THE ATMOSPHERIC DENSITY ON THE DECELERATION OF THE ARTIFICIAL EARTH SATELLITES
P. Ye. Elyasberg and B. V. Kugayenko *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 99-142 refs (For availability see N73-19572 10-19)
CSCL 04A

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-19419* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR PHOTOGRAPHING METEORS Patent
Gale A. Harvey, inventor (to NASA) Issued 23 Jan. 1973 4 p Filed 16 Dec. 1970 Supersedes N72-15415 (10 - 06, p 0770)
(NASA-Case-LAR-10226-1; US-Patent-3,712,195;
US-Patent-Appl-SN-98774; US-Patent-Class-95-11R;
US-Patent-Class-95-11.5R; US-Patent-Class-250-217R) Avail: US Patent Office CSCL 14E

Apparatus for photographing meteors in a selected area of the sky is described. A photomultiplier is pointed in the direction of the area. When a meteor passes through the area the signal output of the photomultiplier increases. Means are provided that activate a camera, pointed at the area, in response to an increased signal from the photomultiplier. Hence, the camera photographs the selected area only while meteors are likely to be passing through the area. Official Gazette of the U.S. Patent Office

N73-19420* Teledyne Brown Engineering, Huntsville, Ala.
SELF-RECORDING PORTABLE SOIL PENETROMETER Patent
Nicholas C. Costes, Rolland G. Sturm, Roland H. Norton, and George E. Campbell, inventors (to NASA) Issued 23 Jan. 1973 10 p Filed 9 Jul. 1971 Supersedes N71-34387 (09 - 21, p 3427) Sponsored by NASA
(NASA-Case-MFS-20774; US-Patent-3,712,121;
US-Patent-Appl-SN-161028; US-Patent-Class-73-84) Avail: US Patent Office CSCL 14B

A lightweight portable penetrometer for testing soil characteristics is described. The penetrometer is composed of a handle, data recording, and probe components detachably joined together. The data recording component has an easily removed recording drum which rotates according to the downward force applied on the handle, and a stylus means for marking the drum along its height according to the penetration depth of probe into the soil. Official Gazette of the U.S. Patent Office

N73-19421* Bendix Corp., Huntsville, Ala.
MULTI AXES VIBRATION FIXTURES Patent
Clifton R. Sims, inventor (to NASA) and Richard C. Taylor Issued 23 Jan. 1973 8 p Filed 28 Dec. 1971 Supersedes N72-20305 (10 - 11, p 1474) Sponsored by NASA
(NASA-Case-MFS-20242; US-Patent-3,712,120;
US-Patent-Appl-SN-213004; US-Patent-Class-73-71.6) Avail: US Patent Office CSCL 14B

A simplified technique and apparatus are described for testing the effects of vibration on various material specimen. Particular attention was given to tests along the orthogonal vibrational planes in order to prove the strength of the item under extraordinary conditions to which it will be subjected.
Official Gazette of the U.S. Patent Office

N73-19422 Virginia Polytechnic Inst., Blacksburg.
A MODEL FOR A SWIRLING-JET PROXIMITY SENSOR Ph.D. Thesis
Krishna Murti Kammula 1972 68 p
Avail: Univ. Microfilms Order No. 72-24449

The fundamental flow problem involved in the design of fluidic proximity sensors was investigated. An experimental study of swirling jets issuing from an annular axisymmetric nozzle fitted with swirler vanes at the exit was made. Measurements of the recirculation zone length, static pressures, and velocity distributions were made for different degrees of swirl, both for a free jet and when the jet impinges on a flat plate at varying distances from the exit. An analytical study was made for predicting the exit static pressure and the length of the recirculation zone. From the above studies, a model has been developed for predicting the optimum geometry and optimum swirl for such sensors.
Dissert. Abstr.

N73-19423 Princeton Univ., N.J.
AIR SPEED MEASUREMENT WITH THE ION BEAM OF THE POSITIVE CORONA DISCHARGE Ph.D. Thesis
Willard Francis Burke 1972 269 p
Avail: Univ. Microfilms Order No. 72-24669

A beam of ions is a sensitive probe with which low air speeds may be accurately measured. The influence of transverse air flow on a beam of ions produced in the positive corona discharge is discussed. Beam deflection is proportional to air speed and depends on gas density and impurity concentrations in air. Sensors are linear in range between .3 m/s and 60 m/s. Error is determined from the quality of the accompanying electronic circuits and meters to be approximately 2%. The problem is how to keep the ratio of deflection to speed constant in a changing environment. An air speed measurement technique is derived which is independent of environmental influences. Air speed is measured independent of gas mass density and humidity. The measurement technique is derived for geometries like those with fine wire or thin needle sources which have relatively low corona thresholds and high current densities. Dissert. Abstr.

N73-19424*# American Science and Engineering, Inc., Cambridge, Mass.

LOXT MIRROR DESIGN STUDY Final Report
Leon VanSpeybroeck, William Antrim, Dave Boyd, Riccardo Giacconi, Gerald Sinnamon, and Frank Stille 12 Oct. 1972 262 p refs
(Contract NAS8-27795)
(NASA-CR-124001; ASE-3096) Avail: NTIS HC $15.25 CSCL 17H

The final report for the large orbiting X-ray telescope (LOXT) high resolution mirror design study is presented. The following tasks were performed: (1) Generation of a reference and alternate preliminary design for the LOXT high resolution mirror assembly, which will meet the LOXT scientific requirements, and are within the present state of the art of materials and fabrication techniques. (2) Measurement, in X-rays, of the scattering properties of a variety of optical flats, embodying materials, coatings, and polishing techniques which might be applicable to the flight configuration LOXT high resolution mirror. (3) Preparation of a procurement specification for a paraboloid test mirror of the size of the innermost paraboloid of the high resolution mirror assembly, including the design requirements for the reference design evolved from this preliminary design study. The results of the engineering and scientific analysis and the conclusions drawn are presented. The procurement specification for the test mirror is included. Author

N73-19425*# Particle Measuring Systems, Boulder, Colo.
THE STUDY AND DEVELOPMENT OF AN ACTIVE SCATTERING PARTICLE SIZE SPECTROMETER FOR SPACE ENVIRONMENTS Final Report
Robert G. Knollenberg 20 Dec. 1972 38 p
(Contract NAS8-28297)
(NASA-CR-124111) Avail: NTIS HC $4.00 CSCL 20F

The work is reported on laser operation in a vacuum, and the theoretical response of active scattering particle spectrometers (ASPS). The theoretical considerations connected with the thermal, interferometric and electrical problems that influence laser operation under vacuum conditions are discussed along with the scattering signal pulses with high frequency ripple content which were observed while operating the ASPS. F.O.S.

N73-19426*# Battelle Columbus Labs., Ohio.
METRICATION STUDY FOR LARGE SPACE TELESCOPE Final Report
F. A. Creswick and A. E. Weller 10 Jan. 1973 73 p refs
(Contract NAS8-29318)
(NASA-CR-124133) Avail: NTIS HC $5.75 CSCL 20F

Various approaches which could be taken in developing a metric-system design for the Large Space Telescope, considering potential penalties on development cost and time, commonality with other satellite programs, and contribution to national goals for conversion to the metric system of units were investigated. Information on the problems, potential approaches, and impacts of metrication was collected from published reports on previous aerospace-industry metrication-impact studies and through numerous telephone interviews. The recommended approach to LST metrication formulated in this study cells for new components and subsystems to be designed in metric-module dimensions, but U.S. customary practice is allowed where U.S. metric standards and metric components are not available or would be unsuitable. Electrical/electronic-system design, which is presently largely metric, is considered exempt from futher metrication. An important guideline is that metric design and fabrication should in no way compromise the effectiveness of the LST equipment. Author

N73-19427*# Santa Barbara Research Center, Goleta, Calif.
OUTER PLANET GRAND TOUR MISSIONS PHOTOMETRY/POLARIMETRY EXPERIMENT CRITICAL COMPONENTS STUDY Final Technical Report
S. F. Pellicori, E. E. Russell, and L. A. Watts 30 May 1972 79 p refs Revised Prepared for Ariz. Univ., Tucson
(Grants NGR-03-002-275; NGR-33-011-033; NGR-05-007-226; Contract W26157)
(NASA-CR-131088) Avail: NTIS HC $6.00 CSCL 14E

Work performed during this effort was limited to two primary areas of technical concern: optical design optimization, and sensor selection. An optical system concept was established, and various system components were evaluated through experimental test sequences. Photodetectors were investigated for the applicability in meeting OPGT requirements as constrained by the photometry/polarimetry team directives. The most promising (gallium arsenide PMT) was further experimentally tested to ascertain its behavior with respect to anticipated environmental conditions. Results of testing and summary of the preceding tradeoff study effort are presented. Author

N73-19428# Joint Publications Research Service, Arlington, Va.
BIAXIAL GYROSTABILIZER AND SUPERCONDUCTING SPHERICAL SUSPENSION
V. G. Afonin 28 Feb. 1973 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 15, no. 12, 1972
(JPRS-58356) Avail: NTIS HC $3.00

Articles, on the application of the averaging method to the analysis of one gyroscopic system and the synthesis of superconducting suspensions with maximum lift, are reported. For individual titles, see N73-19429 through N73-19430.

N73-19429 Joint Publications Research Service, Arlington, Va.
APPLICATION OF AVERAGING METHOD TO ANALYSIS OF ONE GYROSCOPIC SYSTEM
V. G. Afonin *In its* Biaxial Gyrostabilizer and Superconducting Spherical Suspension 28 Feb. 1973 p 1-5 refs (For availability see N73-19428 10-14)

A biaxial gyrostabilizer of the master vertical gyro type, whose equations of motion after the corresponding substitution of variables are analyzed by the averaging method, is examined. Author

N73-19430 Joint Publications Research Service, Arlington, Va.
ON SYNTHESIS OF SUPERCONDUCTING SUSPENSIONS WITH MAXIMUM LIFT
B. A. Ryabov, A. B. Ryabov, A. M. Petrov, and V. A. Gorshkov *In its* Biaxial Gyrostabilizer and Superconducting Spherical Suspension 28 Feb. 1973 p 6-11 refs (For availability see N73-19428 10-14)

Synthesis of the magnetic field of suspension of a superconductor with maximum lift is examined. Synthesis results are presented for a superconducting spherical suspension whose magnetic field has axial symmetry of rotation. Author

N73-19431*# Houston Univ., Tex. Dept. of Civil Engineering.
APPLICATION OF REMOTE SENSING Final Report, period ending 10 Jan. 1973
W. J. Graff, comp. 10 Jan. 1973 152 p refs
(Contract NAS9-12646)
(NASA-CR-128746) Avail: NTIS HC $9.75 CSCL 14E

Remote sensing and aerial photographic interpretation are discussed along with the specific imagery techniques used for this research. The method used to select sites, the results of data analyses for the Houston metropolitan area, and the location of dredging sites along the Houston Ship Channel are presented. The work proposed for the second year of the project is described. F.O.S.

N73-19432# Central Research Inst. for Physics, Budapest (Hungary). Optics Dept.
MICHELSON AND FABRY-PEROT INTERFEROMETERS WITH LIGHT SOURCES OF GAUSSIAN AND LORENTZIAN SPECTRAL DISTRIBUTION
Tamas Salamon 1972 28 p refs Submitted for publication
(KFKI-72-62) Avail: NTIS HC $3.50

The basic properties of Michelson and Fabry-Perot interferometers are reviewed. The time-averaged light detection process is discussed and a general expression which holds for all linear optical transformations is derived. Following descriptions of Gaussian and Lorentzian broadened light spectra, a detailed analysis is presented of the systems obtained by combination of the two interferometer and spectrum types. Author

N73-19433*# Perkin-Elmer Corp., Norwalk, Conn.
ACTIVE OPTICS SIMULATION SYSTEM
Chang H. Chi Jan. 1973 49 p refs
(Contract NAS1-11205)
(NASA-CR-112259) Avail: NTIS HC $4.50 CSCL 20F

The active optics simulation system (AOSS) is a set of

computer programs and associated software to be used in the development, design, and evaluation of a primary mirror control system for a large space telescope, (e.g., the tentatively proposed 3-meter telescope). The mathematical models of component subsystems and the solution of the physical processes that occur within the mirror surface control system were obtained, and based on these models AOSS simulates the behavior of the entire mirror surface control system as well as the behavior of the component subsystems. The program has a modular structure so that any subsystem module can be replaced or modified with minimum disruption of the rest of the simulation program.
Author

N73-19434*# Westinghouse Electric Corp., Elmira, N.Y. Electronic Tube Div.
A PROGRAM TO IMPROVE THE WX-5419B SEC CAMERA TUBE FOR LONG INTEGRATION SATELLITE APPLICATIONS Final Report
Feb. 1972 71 p refs
(Contract NSR-31-001-127)
(NASA-CR-130934) Avail: NTIS HC $5.75 CSCL 09A

The design modifications to the WX-5419B SEC camera tube to make it suitable for astronomical applications are presented. The areas identified for improvement include: gun resolution, elimination of suppressor mesh, reduction of dark current, and UV transmitting input window. F.O.S.

N73-19435# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
FREQUENCY STANDARDS AND CLOCKS: A TUTORIAL INTRODUCTION
Helmut Hellwig Apr. 1972 70 p refs
(AF Order E111M-6)
(NBS-TN-616) Avail: SOD $0.70 as C13.46:616

The topic of frequency standards and clocks is treated in a tutorial and nonmathematical way. The concepts of time, frequency, frequency stability, and accuracy are introduced. The general physical principles and design features of frequency standards and clocks are described. The design, performance, and limitations of quartz crystal oscillators and atomic devices (cesium, hydrogen, rubidium) are discussed in detail and critically compared for laboratory devices as well as for devices intended for field usage. Author

N73-19436*# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
DEVELOPMENT OF MASS SPECTROMETRIC TECHNIQUES APPLICABLE TO THE SEARCH FOR ORGANIC MATTER IN THE LUNAR CRUST Final Technical Report
K. Biemann 15 Feb. 1973 39 p refs
(Contract NAS9-8099)
(NASA-CR-128840) Avail: NTIS HC $4.00 CSCL 14B

Data processing techniques were developed to measure with high precision and sensitivity the line spectra produced by a high resolution mass spectrometer. The most important aspect of this phase was the interfacing of a modified precision microphotometer-comparator with a computer and the improvement of existing software to serve the special needs of the investigation of lunar samples. In addition, a gas-chromatograph mass spectrometer system was interfaced with the same computer to allow continuous recording of mass spectra on a gas chromatographic effluent and efficient evaluation of the resulting data. These techniques were then used to detect and identify organic compounds present in the samples returned by the Apollo 11 and 12 missions. Author

N73-19437*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EVALUATION OF THE ELECTRO-OPTIC DIRECTION SENSOR Final Report
Alan R. Johnson and Phil M. Salomon 1 Feb. 1973 126 p refs
(Contract NAS7-100)
(NASA-CR-130928; JPL-TM-33-598) Avail: NTIS HC $8.50 CSCL 14B

Evaluation of a no-moving-parts single-axis star tracker called an electro-optic direction sensor (EODS) concept is described and the results are given in detail. The work involved experimental evaluation of a breadboard sensor yielding results which would permit design of a prototype sensor for a specific application. The laboratory work included evaluation of the noise equivalent input angle of the sensor, demonstration of a technique for producing an acquisition signal, constraints on the useful field-of-view, and a qualitative evaluation of the effects of stray light. In addition, the potential of the silicon avalanche-type photodiode for this application was investigated. No benefit in noise figure was found, but the easily adjustable gain of the avalanche device was useful. The use of mechanical tuning of the modulating element to reduce voltage requirements was also explored. The predicted performance of EODS in both photomultiplier and solid state detector configurations was compared to an existing state-of-the-art star tracker. Author

N73-19438*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
EOD FACILITIES MANUAL. CAMERA CALIBRATION LABORATORY CAPABILITIES
Nov. 1972 32 p
(Contract NAS9-12200)
(NASA-CR-128825; LEC/HASD-EOD2784; MSC-07576) Avail: NTIS HC $3.75 CSCL 14E

The tests and equipment are described for measuring the exact performance characteristics of camera systems for earth resources, space, and other applications. The tests discussed include: modulation transfer function, field irradiance, veiling glare, T-number tests, shutter speed, spectral transmission, and focal length. F.O.S.

N73-19439*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
CALIBRATION PLAN FOR ULTRAVIOLET SPECTROMETER EXPERIMENT S169
22 Sep. 1971 14 p
(Contract NAS9-11528)
(NASA-CR-128831) Avail: NTIS HC $3.00 CSCL 14B

The calibration test equipment presented is employed to calibrate completely assembled and flight-ready Apollo Ultraviolet Spectrometers (UVS) consisting of a vacuum system in which the UVS can be installed. In it a premonochromator produces a monochromatic beam at any desired wavelength from a UV source. This beam can be focused by an adjustable transfer mirror to any point on the entrance slit of the UVS. The transfer mirror can also direct the beam to one or both of two absolutely calibrated reference photomultiplier tubes to determine the number of photons which enter the UVS. A movable mirror rhomb is also provided to intermittently monitor the number of photons in the beam when the beam is centered on the entrance slit.
Author

N73-19440*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
THE APOLLO 17 FAR ULTRAVIOLET SPECTROMETER EXPERIMENT
William G. Fastie Oct. 1972 33 p refs Submitted for publication
(Contract NAS9-11528)
(NASA-CR-128835) Avail: NTIS HC $3.75 CSCL 14B

The Apollo 17 command service module in lunar orbit will carry a far ultraviolet scanning spectrometer whose prime mission will be to measure the composition of the lunar atmosphere. Additional observations will include the spectral lunar albedo, the temporary atmosphere injected by the engines of the lunar exploration module, the solar system atmosphere, the galactic atmosphere and the spectra of astronomical sources, including the earth. A detailed description of the experimental equipment which observes the spectral range 1180 to 1680 A, the observing program and broad speculation about the possible results of the experiment, are presented. Author

N73-19441*# Advanced Technology Center, Inc., Dallas, Tex.
INVESTIGATION OF SUBSTRATE-MOUNTED THIN-FILM METEOROID SENSORS FOR USE IN LARGE AREA IMPACT EXPERIMENTS
S. F. Carollo, J. M. Davis, and W. E. Dance 26 Feb. 1973 15 p
(Contract NAS9-12009)
(NASA-CR-128862; ATC-B-94500/3CR-7) Avail: NTIS HC $3.00 CSCL 14B

Two types of sensor designs were investigated: (1)a polysulfone dielectric film with vapor-deposited aluminum and gold sensor plates, bonded to a relatively thick aluminum substrate, and (2) an aluminum oxide (A1203) dielectric layer prepared on an aluminum substrate by anodization, with a layer of vapor-deposited aluminum providing one sensor plate and the substrate serving as the other plate. In the first design, specimens were prepared which indicate the state of the art for application of this type of sensor for elements of a meteoroid detection system having an area as large as 10 sq M. Techniques were investigated for casting large-area polysulfone films on the surface of water and for transferring the films from the water. Methods of preparing sensors by layering of films, the deposition of capacitor plates, and sensor film-to-substrate bonding, as well as techniques for making electrical connections to the capacitor plates, were studied. Author

N73-19442# Sandia Labs., Albuquerque, N.Mex.
EMR 6130 (DADS SYSTEM 2) ON LINE STATION: RADIATION EFFECTS SEMICONDUCTOR TESTER
C. D. Longerot Aug. 1972 28 p refs Sponsored by AEC
(SC-DR-72-0525) Avail: NTIS

One of several on-line laboratory stations connected to the real-time/time-share EMR 6130 centralized computer is described. The test station described allows real-time data acquisition and display in support of semiconductor radiation effects studies through the use of a programmable test controller and graphic display terminal. Author (NSA)

N73-19443# Oak Ridge National Lab., Tenn.
NUCLEAR AND X-RAY TECHNIQUES
W. S. Lyon 1972 14 p refs Presented at Interagency Conf. on the Environ., Livermore, Calif., 17 Oct. 1972 Sponsored by AEC
(Conf-721002-1) Avail: NTIS

The application of nuclear and X-ray techniques for examination of environmental pollution samples is discussed. Neutron, photon, and charged particle activation analyses are examples of nuclear techniques used. X-ray fluorescence, induced by X-rays or charged particles, provide elemental analysis at low cost. Specialized techniques are described as follows: (1) stable isotope use, (2) spark source mass spectrometry for multi-element analysis, and sorption chromatography for determining trace organics in water. Author (NSA)

N73-19444# Bergen Univ. (Norway). Dept. of Physics.
SOLID STATE CHARGED PARTICLE SPECTROMETER IN THE ROCKET PROTON 1
H. R. Lindalen, F. Soeraas, S. Njaastad, and T. Ryngoeye Apr. 1972 23 p refs
(NP-19462; Rept-40) Avail: AEC Depository Libraries

The experiment was designed for use in rockets with a pulse code modulated (PCM) telemetry system. It will measure the differential energy spectrum and pitchangle distribution of electrons and protons above 20 keV with high resolution. It is part of the payload in the two Nike-Tomahawk rockets, Proton 1 and 2, which were built to investigate various aspects of the particle precipitation at high latitudes with emphasis on the proton precipitation. Proton 1 was launched on February 13, 1972, and, while it is too early to present scientific results, it is apparent that the equipment has functioned as expected. NSA

N73-19445# Los Alamos Scientific Lab., N.Mex.
FILM IMAGE SYNCHRONIZED, ROTATING-SLIT SHUTTERED DRUM FIELD CAMERAS FOR PROJECTILE-IN-FLIGHT PHOTOGRAPHY
Paul M. Giles 1972 13 p refs Presented at Symp. of Soc. of Phot. Instrumentation Engr., San Francisco, 16 Oct. 1972 Sponsored by AEC
(LA-DC-72-909; Conf-721032-1) Avail: NTIS

The application of film-image synchronized, rotating-slit shuttered cameras for photography of projectiles in flight is discussed. The construction and operations of the cameras are described. The techniques for photographing projectiles under various conditions are explained. Author (NSA)

N73-19446# Los Alamos Scientific Lab., N.Mex.
HOLOGRAPHIC INTERFEROMETRY COOKBOOK
F. C. Jahoda and R. E. Siemon Oct. 1972 18 p refs
(Contract W-7405-eng-36)
(LA-5058) Avail: NTIS

Various approaches to pulsed holographic interferometry are described and reasons are given for preferring nondiffuse holograms which contain on the hologram an image of the plasma. Many details often omitted from more formal publications are given concerning laser requirements, optical components, recording materials, and so on. A discussion is given of the interpretation of plasma interferograms in which it is emphasized that interferometric data is very useful quantitatively as well as qualitatively. Author (NSA)

N73-19447# California Univ., Livermore. Lawrence Livermore Lab.
POSITRON/SCINTILLATION CAMERA DATA ACQUISITION AND DISPLAY SYSTEM
Ervin Behrin 20 Oct. 1972 17 p refs
(Contract W-7405-eng-48)
(UCRL-51288) Avail: NTIS

A positron scintillation camera data acquisition and display system located at the 100 MeV linear accelerator facility is described. The camera consists of two identical 16-in. diam Anger scintillation detectors. The camera outputs are sampled, digitized and routed through a PDP-15 computer onto a high-speed drum storage device. A software operating and display system has been developed. Some applications are described. Author (NSA)

N73-19448# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Inst. fuer Strahlenschutz.
DEVELOPMENT AND USE OF A SPARK COUNTER FOR THE FAST EVALUATION OF SOLID STATE TRACK DETECTORS [ENTWICKLUNG UND EINSATZ EINES FUNKENZAEHLERS ZUR SCHNELLEN AUSWERTUNG VON KERNSPURDETEKTOREN]
H. G. Paretzke Bonn Bundeswehramt 1972 22 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-33) Avail: NTIS HC $3.25; Bundeswehramt, Bonn: 25 DM

A spark counter was developed for fast evaluation of thin detectors with a density range of 0.1 to 1000 tracks/sq cm. The apparatus differs from other spark counters mainly because it is battery powered, versatile, easily transportable, and simple to operate. The influence of etching and operation parameters on the result and the reproducibility of the measuring method were investigated with this device. This was done especially for Makrofol detectors irradiated in 2 Pi geometry with fission fragments of the U(n,f) reaction. Author (ESRO)

N73-19449# Oxford Univ. (England). Engineering Lab.
DYNAMIC PLASTICITY UNDER COMBINED STRESSES. THE DEVELOPMENT AND USE OF A MEDIUM-RATE TENSION-TORSION MACHINE
M. R. D. Randall and J. D. Campbell Dec. 1972 68 p refs
(Rept-1047/72) Avail: NTIS HC $5.00

The dynamic behavior of materials under complex stresses is discussed. A description is given of a new hydraulically-operated medium-rate testing machine, capable of loading tabular specimens in simultaneous tension and shear. The associated electronic instrumentation, providing accurate indication of specimen loads and deflections, is described, together with a computer program written and used to calculate near-continuous data concerning the material state throughout the test. Results are presented for commercially pure aluminum, a low-carbon steel, and commercially pure titanium. Stress-strain curves, initial and subsequent yield surfaces, stress histories throughout tests, and the dependences of plastic flow stress upon strain rate are shown. The validity of effective stress and effective strain terms is discussed, and also the degree of agreement of the experimental results with hypothetical yield functions. The normality rule of plastic flow is shown to give an accurate indication of plastic stress-strain relations. Author (ESRO)

N73-19450# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
ACTIVITIES OF THE DIVISION OF QUANTUM METROLOGY Annual Report, 1971

[1972] 64 p ref
(NPL-QU-AR-71) Avail: NTIS HC $5.25

Work carried out during the year 1971 on improvement of the ampere unit, the gyromagnetic ratio of the proton, measurement of Avogadro's constant, magnetic moment of the proton, and the Faraday unit is reported. The development of a cesium primary standard is analyzed. The main experimental difficulties encountered in measurement of carbon dioxide laser frequencies were overcome. The Georan program for accurate long distance measurement is described. Vacuum ultraviolet wavelength, luminous intensity, color temperature, spectral emission, spectral responsivity standards, thermodynamics, and temperature measurement are also discussed. ESRO

N73-19451# Defence Research Information Centre, Orpington (England).
SCANNING ELECTRON MICROSCOPY OF DIELECTRICS
G. V. Spivak and E. J. Rau Nov. 1972 9 p refs Transl. into ENGLISH from Bull. Acad. Sci. USSR Phys. Ser., v. 6, no. 36, 1972 p 1312-1315
(DRIC-Trans-2970; BR-30334) Avail: NTIS HC $3.00

When examining samples of low conductivity with a scanning electron microscope, charging of the body and surface takes place which leads to poor resolution. Methods to prevent charging are briefly reviewed, but it is pointed out that in some cases charging is useful as it leads to enhanced image contrast. This effect is discussed, and ways are given to remove the charge when desired. The advantages and disadvantages of these methods are considered. ESRO

N73-19452# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
ZERO-G GAUGING SYSTEMS Final Report
J. R. Sanmartin, E. Fraga, and A. Munoz Jun. 1972 59 p refs
(Contract ELDO-CTR-17/8/4)
Avail: NTIS HC $5.00

Various systems for measuring propellant content in spacecraft under conditions of weightlessness are reviewed. The cavity resonator method is found to be the most suitable measurement technique. This method is analyzed in detail. Errors inherent to the method are determined. ESRO

N73-19453# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
UNIT RECORD CARD GRAPHIC TECHNIQUES Final Technical Report, 1 Dec. 1970 - 31 Jul. 1972
John E. Bigelow and Siegfried Aftergut Ft. Monmouth, N. J. ECOM Dec. 1972 67 p refs
(Contract DAAB07-71-C-0073; DA Proj. 1H6-62701-A-484)
(AD-753602; SRD-72-100; ECOM-0073-F) Avail: NTIS CSCL 14/5

Work during a 20-month program to develop graphical techniques for a unit record card based on photoplastic film is described. The unit record card will ultimately permit a combination of machine-readable characters, man-readable characters, and high-density graphic material (such as engineering drawings and photographs) to be stored readily on and retrieved from a reusable 3- by 5-inch card. Photoplastic film is a photoconductive, thermoplastic, recording film which permits rapid dry development, add-on capability, and reuse. The work includes efforts to optimize film performance and produce a quantity of cards and design, construction, and testing of equipment to record, process, project, duplicate, produce hard copy facsimiles from, and erase these cards. Tests are described showing that major performance goals were met. Author (GRA)

N73-19454# Aerojet Solid Propulsion Co., Sacramento, Calif.
DEVELOPMENT OF AN IN-SITU TRANSMITTER FOR SOLID ROCKET SURVEILLANCE Final Report, 3 May - 3 Jul. 1972
Herman P. Briar and Kenneth W. Bills, Jr. Dec. 1972 210 p refs
(Contract F04611-71-C-0044)
(AD-754253; AFRPL-TR-93) Avail: NTIS CSCL 21/9

The program was designed to evaluate the feasibility of making in-situ propellant mechanical properties measurements, then to develop the instrumentation and telemetry necessary to transmit the data out of the grain to a receiver. At the conclusion of this Air Force sponsored program ASPC had in operation eight in-situ, wireless telemetry units. Three of the units had been successfully cast into large blocks of propellant. These units had an active sensor, called a Duomorph, that can operate dynamically over the range from 5 to 5000 hz. The Duomorph sensor and the telemetry units were developed after an extensive literature survey indicated that telemetry through propellant was both feasible and safe, and dynamic deformations of an active sensor are the most convenient designs for remote telemetric control. Author (GRA)

N73-19455# Stanislaus State Coll., Turlock, Calif.
CRYOGENIC GRAVITY METER Final Report, Aug. 1971 Sep. 1972
Vladimir S. Tuman and Ahmad Waleh Sep. 1972 103 p refs
(Contract F19628-72-C-0010; AF Proj. 8607)
(AD-754242; AFCRL-72-0580) Avail: NTIS CSCL 14/2

The report describes the progress made towards the design and fabrication of a cryogenic gravity meter intended to have a sensitivity of about 25 millimicrogal. The cryogenic gravity meter consists of two parts--a suspension unit and a detection module. The suspension unit is a cylindrically symmetric superconducting magnet with a large magnetic field and a small magnetic field gradient at its geometrical center which supports a superconducting hollow niobium sphere. The detection module is a Josephson junction magnetometer which detects the magnetic flux change due to the motion of the hollow sphere. A feedback circuit is used to keep the magnetometer phase locked on the motion of the sphere a portion of the feedback signal is recorded on an analog recorder. The signal on the recorder is directly proportional to the position of the sphere. The periods between 0.5 seconds to 3 seconds and Q from 2.3 to 20 have been studied in this report. Trapping of flux in the ball seems to be one of the major difficulties encountered. Author (GRA)

N73-19818 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
HIGH SPEED SCHLIEREN FILM OF THE PULSATING FLOW IN A TRANSONIC TURBINE CASCADE
O. Lawaczeck *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 469-473 refs (For availability see N73-19794 10-28)

N73-19117* Techtran Corp., Glen Burnie, Md.
THE PHOTOSTAT-1 DEVICE FOR STUDYING THE REACTION OF ORGANISMS TO PHYSICAL CONDITIONS ON THE PLANET MARS
E. I. Zaar, V. G. Zelikson, M. G. Kitaygorodskiy, I. V. Koshelev, L. K. Lozina-Lozinskiy, and M. A. Rybin *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 371-377 refs (For availability see N73-19077 10-04)
CSCL 14B

N73-19633 Joint Publications Research Service, Arlington, Va.
CONSTRUCTION OF FREQUENCY SPECTRUM OF THREE-STAGE GYROSCOPE WITH FLEXIBILE ROTOR SHAFT AND ELASTIC CARDAN SUSPENSION MOUNTS
V. A. Kareline *In its* Inertial Systems 7 Feb. 1973 p 1-7 refs (For availability see N73-19632 10-21)

N73-19634 Joint Publications Research Service, Arlington, Va.
ON SYSTEMATIC DRIFT OF GYROSCOPE WITH VARIABLE KINETIC MOMENT IN CARDAN SUSPENSION DURING OSCILLATIONS OF PLATFORM
V. V. Savelyev *In its* Inertial Systems 7 Feb. 1973 p 8-12 refs (For availability see N73-19632 10-21)

N73-19635 Joint Publications Research Service, Arlington, Va.
CONDITION OF DRIFT INVARIANCE OF TWO-STAGE GYROSCOPE WITH ARBITRARY GAS-LUBRICATED MAIN BEARINGS TO ACTIVE ACCELERATIONS
S. G. Dadayev and G. A. Zavyalov *In its* Inertial Systems 7 Feb. 1973 p 13-17 refs (For availability see N73-19632 10-21)

N73-19637 Joint Publications Research Service, Arlington, Va.
ON HYDRAULIC DAMPING OF THE SENSORS OF DIFFERENTIAL MANOMETERS OF DYNAMIC PRESSURE LOGS

A. D. Kuznetsov and V. I. Yushchenko *In its* Inertial Systems 7 Feb. 1973 p 23-28 refs (For availability see N73-19632 10-21)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-19456 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION OF THE TEMPERATURE IN THE PLASTIC ZONE IN THE EXTRUSION PROCESS
A. M. Rytikov Dec. 1972 10 p refs Transl. into ENGLISH from Tsvetn. Metal. (Moscow), v. 1, 1970 p 64-68
(NLL-RTS-6867) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.90; 3 NLL photocopy coupons

Heavy nonferrous metals and alloys, steels, titanium and other metals are extruded from a cylinder for temperature calculations in the plastic zone. The large temperature gradient between the metal and the tool producing a sudden cooling is studied. The additive components of temperature in the plastic zone are determined analytically. J.A.M.

N73-19457* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCESS FOR MAKING DIAMONDS Patent
John R. Rasquin and Marvin F. Estes, inventors (to NASA) Issued 30 Jan. 1973 5 p Filed 21 Apr. 1971 Supersedes N72-21481 (10-11, p 1479) Continuation-in-part of US Patent Appl. SN-3418, filed 16 Jan. 1970
(NASA-Case-MFS-20698-2; US-Patent-3,714,332; US-Patent-Appl-SN-136086; US-Patent-Class-423-446; US-Patent-Class-423-625; US-Patent-Appl-SN-3418) Avail: US Patent Office CSCL 13H

A description is given of a device and process for making industrial diamonds. The device is composed of an exponential horn tapering from a large end to a small end, with a copper plate against the large end. A magnetic hammer abuts the copper plate. The copper plate and magnetic hammer function together to create a shock wave at the large end of the horn. As the wave propagates to the small end, the extreme pressure and temperature caused by the wave transforms the graphite, present in an anvil pocket at the small end, into diamonds.
Official Gazette of the U.S. Patent Office

N73-19458* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ZERO GRAVITY LIQUID MIXER Patent
Franklin W. Booth and Robert A. Bruce, inventors (to NASA) Issued 23 Jan. 1973 6 p Filed 24 Nov. 1971 Supersedes N72-21488 (10 - 12, p 1618)
(NASA-Case-LAR-10195-1; US-Patent-3,712,591; US-Patent-Appl-SN-201782; US-Patent-Class-259-4) Avail: US Patent Office CSCL 13I

An apparatus for mixing liquids under conditions of zero gravity is disclosed. The apparatus is comprised of a closed reservoir for the liquids, with a means for maintaining a positive pressure on the liquids in the reservoir. A valved liquid supply line is connected to the reservoir for supplying the reservoir with the liquids to be mixed in the reservoir. The portion of the reservoir containing the liquids to be mixed is in communication with a pump which alternately causes a portion of the liquids to flow out of the pump and into the reservoir to mix the liquids. The fluids in the reservoir are in communication through a conduit with the pump which alternately causes a portion of the fluids to flow out of the pump and into the sphere. The conduit connecting the pump and sphere may contain a nozzle or other jet-forming structure such as a venturi for further mixing the fluids. Official Gazette of the U.S. Patent Office

N73-19459*# Aerojet Liquid Rocket Co., Sacramento, Calif. Control Systems Section.
DESIGN, FABRICATION, TESTING AND DELIVERY OF A PROTOTYPE SELF-LOCKING ACTUATOR Final Report
J. E. Dever 19 Jan. 1973 56 p
(Contract NAS8-28247)
(NASA-CR-124135; CS-47) Avail: NTIS HC $5.00 CSCL 13I

The design, fabrication, and testing of a prototype self-locking actuator capable of producing an axial force of 44.5 kN are reported. The actuator passed the initial proof test successfully, however, when the no-load rate test was attempted, the actuator would not extend from the fully contracted position. Author

N73-19460# Joint Publications Research Service, Arlington, Va.
SELECTED TRANSLATIONS ON WELDING
22 Feb. 1973 24 p refs Transl. into ENGLISH from Svar. Proizv. (Moscow), no. 12, 1972
(JPRS-58291) Avail: NTIS HC $3.25

Articles are presented on the redistribution and removal of residual welding stresses by loading a forge-welded vessel with an internal pressure, contact-reactive ceramic-metal brazing, butt welding of titanium alloy rings, and a vacuum-diffusion welding unit. For individual titles, see N73-19461 through N73-19464.

N73-19461 Joint Publications Research Service, Arlington, Va.
LOWERING THE RESIDUAL STRESSES IN WELD JOINTS OF FORGE WELDED VESSELS BY HYDROCOMPRESSION
V. I. Etingov and N. N. Mikhaylova *In its* Selected Transl. on Welding 22 Feb. 1973 p 1-8 refs (For availability see N73-19460 10-15)

The redistribution and removal of residual welding stresses were investigated by loading a forge-welded low alloy carbon steel vessel with an internal pressure. Tests were conducted on membrane samples in their initial state as well as after loading. Results indicate that lowering or redistribution of residual stresses depends on both the membrane's initial level and the magnitude of the applied load. It was concluded that internal loading by means of hydrocompression leads to the removal of residual stresses. J.M.M.

N73-19462 Joint Publications Research Service, Arlington, Va.
CONTACT REACTIVE CERAMIC METAL BRAZING
V. P. Kruchinin and I. I. Metelkin *In its* Selected Transl. on Welding 22 Feb. 1973 p 9-17 refs (For availability see N73-19460 10-15)

The method for contact-reactive brazing is discussed regarding the production of ceramic-metal compounds. The quality of ceramic-metal joints produced by this method is shown to depend on the surface finish of the ceramic, the brazing temperature, the braze alloy composition, and the physical and chemical properties of the alloys. Those studied for thermal stability and bend strength were molybdenum, constantan, copper, niobium, and tantalum alloys. It was determined that increasing the surface finish of the ceramic from class 6-7 to 8-9 makes it possible to produce ceramic-metal braze joints with a 20% to 30% increase in mechanical strength. J.M.M.

N73-19463 Joint Publications Research Service, Arlington, Va.
BUTT WELDING OF TITANIUM ALLOY VT5-1 RINGS
I. Ya. Zubarev *In its* Selected Transl. on Welding 22 Feb. 1973 p 18 (For availability see N73-19460 10-15)

A more economic method of producing ring blanks from strip was developed using free-forging, bending, and contact-butt welding techniques to increase the coefficient of material utilization by a factor of two to three. A satisfactory welding quality was provided by this mode with the following improved mechanical properties: tensile strength, yield strength, elongation, reduction in area, and impact strength. J.M.M.

N73-19464 Joint Publications Research Service, Arlington, Va.
VACUUM DIFFUSION WELDING UNIT
G. V. Konyushkov, A. A. Myagkov, and G. F. Zelenov *In its* Selected Transl. on Welding 22 Feb. 1973 p 19-21 (For availability see N73-19460 10-15)

Vacuum-diffusion weld units were produced for the diffusion welding of parts made of similar and dissimilar metals, alloys, ceramics, and graphites. These units produce weld joints of 400

different compositions which are identical to their initial state relative to strength, ductility, thermal stability, and electrical conductivity. In addition, these units combine the process of joining parts and assemblies with their vacuum or hydrogen annealing, vacuation of electrovacuum instruments, and sintering. J.M.M.

N73-19465*# Arizona Univ., Tucson. Engineering Experiment Station.
MODERN METHODOLOGY OF DESIGNING TARGET RELIABILITY INTO ROTATING MECHANICAL COMPONENTS Final Report
Dimitri B. Kececioglu and Louie B. Chester 31 Jan. 1973 197 p refs
(Grant NGR-03-022-044)
(NASA-CR-120967) Avail: NTIS HC $12.00 CSCL 13I

Experimentally determined distributional cycles-to-failure versus maximum alternating nominal strength (S-N) diagrams, and distributional mean nominal strength versus maximum alternating nominal strength (Goodman) diagrams are presented. These distributional S-N and Goodman diagrams are for AISI 4340 steel, R sub c 35/40 hardness, round, cylindrical specimens 0.735 in. in diameter and 6 in. long with a circumferential groove 0.145 in. radius for a theoretical stress concentration = 1.42 and 0.034 in. radius for a stress concentration = 2.34. The specimens are subjected to reversed bending and steady torque in specially built, three complex-fatigue research machines. Based on these results, the effects on the distributional S-N and Goodman diagrams and on service life of superimposing steady torque on reversed bending are established, as well as the effect of various stress concentrations. In addition a computer program for determining the three-parameter Weibull distribution representing the cycles-to-failure data, and two methods for calculating the reliability of components subjected to cumulative fatigue loads are given. Author

N73-19466# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND CONTROL OF CAST STEEL PARTS PRIOR TO GEAR MACHINING
L. X. Napomuceno and M. F. Barbosa 30 Oct. 1972 4 p ref In PORTUGUESE; ENGLISH summary
(Rept-7210.614) Avail: NTIS HC $3.00

The results of ultrasonic inspection of cast steel parts are reported. The equipment and procedures are described. A schematic of the inspected part is included. Author

N73-19467*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BONDING OF SAPPHIRE TO SAPPHIRE BY EUTECTIC MIXTURE ALUMINUM OXIDE AND ZIRCONIUM OXIDE Patent Application
John J. DeLuca, inventor (to NASA) Filed 12 Jan. 1973 11 p
(NASA-Case-GSC-11577-1; US-Patent-Appl-SN-322997) Avail: NTIS HC $3.00 CSCL 13H

The bonding of an element comprising sapphire, ruby, or blue sapphire to another element of such material with a eutectic mixture of aluminum oxide and zirconium oxide is described. The bonding mixture may be applied in the form of a distilled water slurry or by electron beam vapor deposition. In one embodiment the eutectic is formed in situ by applying a layer of zirconium oxide and then heating the assembly to a temperature above the eutectic temperature and below the melting point of the material from which the elements are formed. The formation of a sapphire rudi dium maser cell utilizing eutectic bonding is shown. NASA

N73-19468*# LTV Aerospace Corp., Dallas, Tex. Engineering Materials and Processes Group.
FABRICATION PROCESS SCALE-UP AND OPTIMIZATION FOR A BORON-ALUMINUM COMPOSITE RADIATOR Final Report, Jan. - Nov. 1972
K. P. OKelly [1973] 131 p refs
(Contract NAS9-8260)
(NASA-CR-128805; Rept-00-1579) Avail: NTIS HC $8.75 CSCL 13H

Design approaches to a practical utilization of a boron-aluminum radiator for the space shuttle orbiter are presented. The program includes studies of laboratory composite material processes to determine the feasibility of a structural and functional composite radiator panel, and to estimate the cost of its fabrication. The objective is the incorporation of boron-aluminum modulator radiator on the space shuttle. Author

N73-19469# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND CONTROL OF PRESSURE VESSEL STEEL PLATES
L. X. Nepomuceno and M. F. Barbosa 26 Sep. 1972 7 p refs In PORTUGUESE; ENGLISH summary
(TR-7209-601-B) Avail: NTIS HC $3.00

The results of ultrasonic inspection of steel plates for a pressure vessel are presented. The equipment, vessel, procedures, and specifications used in the inspection are described. Schematics showing the location of defects are included. Author

N73-19470# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND CONTROL OF PRESSURE VESSEL STEEL PLATES
L. X. Nepomuceno and M. F. Barbosa 12 Sep. 1972 9 p In PORTUGUESE; ENGLISH summary
(TR-7209-601) Avail: NTIS HC $3.00

The equipment, accessories and procedure used for the ultrasonic control and inspection of the steel plates of a large size pressure vessel are described. The results are presented in schematics showing defect positions. Photos of the observed echograms are included. Author

N73-19471# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC CONTROL AND INSPECTION OF CAST STEEL PARTS FOR GEAR MACHINING
L. X. Nepomuceno and M. F. Barbosa 30 Oct. 1972 6 p In PORTUGUESE; ENGLISH summary
(TR-7210-617) Avail: NTIS HC $3.00

The results of ultrasonic inspection of cast steel parts are reported. The equipment and procedures are described. Author

N73-19472# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF CAST STEEL BLOCKS, HIGH QUALITY STEEL PLATES AND JUNCTIONS IN STEEL STRUCTURAL BODIES
L. X. Nepomuceno and M. F. Barbosa 10 Oct. 1972 10 p In PORTUGUESE; ENGLISH summary
(TR-7210-607) Avail: NTIS HC $3.00

The equipment, procedure, specifications and accessories used for the ultrasonic inspection of steel plates, cast steel blocks and riveted junctions in steel structural bodies are described. Schematics are presented showing the location of the defects along with photographs of the echograms. Author

N73-19473# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
NOISE MEASUREMENTS AND OCTAVE BAND ANALYSIS FOR NOISE POLLUTION CONTROL
L. X. Nepomuceno 26 Sep. 1972 28 p In PORTUGUESE; ENGLISH summary
(TR-7209-602) Avail: NTIS HC $3.50

The location of the facility, and the selected points for noise measurements are described along with the equipment and procedures. Graphs of the results are presented showing the noise level and frequency of the measurements.
Transl. by F.O.S.

N73-19474# Australian Post Office Research Labs., Melbourne.
DEVELOPMENT OF A SUGGESTED DESIGN FOR POLYTHENE SHEATHED CLOSURES ON LARGE SIZE CABLES
H. J. Ruddell Jun. 1972 16 p refs
(Rept-6713) Avail: NTIS HC $3.00

An alternative method to the current epoxy resin adhered lead auxiliary sleeve joint for large size polythene sheathed cable, which is based on a polythene sleeve thermally shrunk and welded to the cable sheath, was evaluated. To reach finalization requires the introduction into the Australian plastics industry a new but proven technology of rotational injection moulding. However, it is possible that some of the sections of the jointing system may have application in a future jointing procedure. Author

N73-19475# Battelle Inst., Frankfurt am Main (West Germany).
APPLICATION OF THE LOW-TEMPERATURE CVD PROC-

ESS
K. H. Bloss and H. Lukas 1971 38 p refs
Avail: NTIS HC $4.00

The low temperature CVD process, a specific version of the single vapor deposition procedure, is presented and its potential applications are described. The important features that have led to the designation low temperature CVD process are outlined. Besides organometals as pyrolyzable compounds, evaporation and pyrolysis, diffusion zone and hydrodynamics, especially the determination of the deposition conditions are discussed in detail. This discussion covers practice-oriented rather than theoretical approaches to the problem. The applications of deposition from the vapor phase at low temperatures are discussed. This discussion includes protective coatings against corrosion and wear, optical and decorative coatings, pigments, and fillers. Author

N73-19476*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A SOLENOID FAILURE DETECTION SYSTEM FOR COLD GAS ATTITUDE CONTROL JET VALVES Phase 2 Final Report, Mar. 1969 - Jul. 1970
Phillip A. Johnston Nov. 1970 28 p Prepared for JPL
(Contracts NAS7-100; JPL-952578)
(NASA-CR-130931; Doc-70SD4285) Avail: NTIS HC $3.50 CSCL 14D

The development of a solenoid valve failure detection system is described. The technique requires the addition of a radioactive gas to the propellant of a cold gas jet attitude control system. Solenoid failure is detected with an avalanche radiation detector located in the jet nozzle which senses the radiation emitted by the leaking radioactive gas. Measurements of carbon monoxide leakage rates through a Mariner type solenoid valve are presented as a function of gas activity and detector configuration. A cylindrical avalanche detector with a factor of 40 improvement in leak sensitivity is proposed for flight systems because it allows the quantity of radioactive gas that must be added to the propellant to be reduced to a practical level. Author

N73-19477*# TRW Systems Group, Redondo Beach, Calif.
PROPELLANT ISOLATION SHUTOFF VALVE PROGRAM Final Report
F. L. Merritt Feb. 1973 180 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953029)
(TRW-73.4781.6-15) Avail: NTIS HC $11.00 CSCL 13K

An analysis and design effort directed to advancing the state-of-the-art of space storable isolation valves for control of flow of the propellants liquid fluorine/hydrazine and Flox/monomethylhydrazine is discussed. Emphasis is on achieving zero liquid leakage and capability of withstanding missions up to 10 years in interplanetary space. Included is a study of all-metal poppet sealing theory, an evaluation of candidate seal configurations, a valve actuator trade-off study and design description of a pneumo-thermally actuated soft metal poppet seal valve. The concepts and analysis leading to the soft seal approach are documented. A theoretical evaluation of seal leakage versus seal loading, related finishes and yield strengths of various materials is provided. Application of a confined soft aluminum seal loaded to 2 to 3 times yield strength is recommended. Use of either an electro-mechanical or pneumatic actuator appears to be feasible for the application. Author

N73-19478*# Franklin Inst. Research Labs., Philadelphia, Pa.
INVESTIGATION OF A HYDROSTATIC AZIMUTH THRUST BEARING FOR A LARGE STEERABLE ANTENNA Final Report, 17 May 1972 - 27 Oct. 1972
J. Rumberger, V. Castelli (Columbia Univ.), and H. Rippel 27 Oct. 1972 81 p refs
(Contract JPL-953457; FIRL Proj. 32G-C3388-01)
(NASA-CR-130930; F-C3388) Avail: NTIS HC $6.25 CSCL 13I

The problems inherent in the design and construction of a hydrostatic azimuth thrust bearing for a tracking antenna of very large size were studied. For a load of 48,000,000 lbs., it is concluded that the hydrostatic bearing concept is feasible, provided that a particular multiple pad arrangement, high oil viscosity, and a particular load spreading arrangement are used. Presently available computer programs and techniques are deemed to be adequate for a good portion of the design job but new integrated programs will have to be developed in the area of the computation of the deflections of the supporting bearing structure. Experimental studies might also be indicated to ascertain the life characteristics of grouting under cyclic loading, and the optimization of hydraulic circuits and pipe sizes to insure the long life operation of pumps with high viscosity oil while avoiding cavitation. Author

N73-19479*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
A SURVEY OF ACTUATOR SHAFT SEALING TECHNIQUES FOR EXTENDED SPACE MISSIONS
G. M. Hotz 15 Dec. 1972 37 p refs
(Contract NAS7-100)
(NASA-CR-130927; JPL-TM-33-587) Avail: NTIS HC $4.00 CSCL 11A

Actuators for control and articulation aboard Mariner spacecraft have employed output shaft seals to maintain an internal gaseous atmosphere. On future missions, considerably greater expected lifetimes, temperature ranges, and radiation exposures have led to a need to determine the limitations of the present O-ring output shaft seal and to examine other candidate seals. Seals suited both to dynamic and static sealing were examined for potential use in three specific actuator applications and the following candidate seals were selected: (a) O-ring seal, (b) chevron seal, (c) bellows seal (linear actuator only), (d) magnetic fluid seal (rotary actuators only) and as a backup seal to any of the foregoing, (e) the labyrinth seal. Author

N73-19480*# Union Carbide Corp., Parma, Ohio. Carbon Products Div.
DEVELOPMENT OF SEAL RING CARBON-GRAPHITE MATERIALS (TASKS 5, 6, AND 7)
N. J. Fechter and P. S. Petrunich 10 Aug. 1972 120 p refs
(Contract NAS3-13211)
(NASA-CR-120955) Avail: NTIS HC $8.00 CSCL 11A

Carbon-graphite seal ring bodies for operation at air temperatures to 1300 F(704 C) were manufactured from three select formulations. Mechanical and thermal properties, porosities, and oxidation rates were measured. The results have shown that: (1) Major property improvements anticipated from the screening studies were not realized because of processing problems associated with the scale-up in material size and probable deterioration of a phenolic resin binder; (2) the mechanical properties of a phenolic resin-bonded, carbon-graphite material can be improved by applying high pressure during carbonization; and (3) the textile form of graphite fiber used as the minor filler component in a carbon-graphite material can beneficially affect mechanical properties. Author

N73-19481*# Union Carbide Corp., Parma, Ohio. Carbon Products Div.
DEVELOPMENT OF SEAL RING CARBON-GRAPHITE MATERIALS (TASKS 8, 9, AND 10)
N. J. Fechter and P. S. Petrunich Jan. 1973 86 p refs
(Contract NAS3-13211)
(NASA-CR-121092) Avail: NTIS HC $6.50 CSCL 11A

A screening study was conducted to develop improved carbon-graphite materials for use in self-acting seals at air temperatures to 1300 F (704 C). Property measurements on materials prepared during this study have shown that: (1) The mechanical properties of a carbon-graphite material were significantly improved by using a fine milled artificial graphite filler material and including intensive mixing, warm molding, and pitch impregnation in the processing; and (2) the oxidation resistance of a carbon-graphite material was improved by including fine milled boron carbide as an oxidation-inhibiting additive. These techniques were employed to develop a material that has 10 times more oxidation resistance than that of a widely used commercial grade and mechanical properties that approach those of the commercial grade. Author

N73-19482*# Kanner (Leo) Associates, Redwood City, Calif.
COMPENDIOUS REPORT ON DISK WAVE DRIVE (DIWA)
H. Kleinwaechter Washington NASA Feb. 1973 5 p Transl. into ENGLISH of "Kurzmitteilung zum Diskus-Wellen-Antrieb DIWA" Loerrach, West Germany, Elektronik fuer Raumfahrt und Atomtechnik press release, 1 Oct. 1972 2 p
(Contract NASw-2481)

(NASA-TT-F-14803) Avail: NTIS HC $3.00 CSCL 13I

A novel design together with a variant of a gear motor and of a telemanipulator is reported. An elastically geared circular disk is made to engage with a rigid bevel gear which has the same pitch but two teeth less than the circular disk at two diametrical locations on its circumference by means of a rotating magnetic field or, in the variant, by sequentially inflated elastic expansion chambers. In this manner, a reduction ratio of several hundred is attained. The telemanipulators are made up of independent universal joint capsules. Each capsule contains a drive motor, a highly reduced gear train as well as angle, torque, and temperature sensors. Current and air conduits are ducted through hollow axles. Author

N73-19483# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

IMPROVED TECHNIQUE FOR PRODUCING HIGH SURFACE FINISH BERYLLIUM FOIL

John G. Avery and James F. Norris 2 Oct. 1972 9 p ref

(Contract AT(29-1)-1106)

(RFP-1842) Avail: NTIS

A method of producing beryllium foil with a better surface finish than present foil, and at a lower cost than the present method, has been conceptually devloped. This method is performed with the rolls and at beryllium 800 F, which is just below the temperature at which significant oxidation of beryllium begins. Subsequent annealing at 1200 F in a .000001 torr vacuum produces a ductile foil whose surface does not require etching to remove oxide. Author (NSA)

N73-19484# Iowa State Univ. of Science and Technology, Ames. Ames Lab.

GENERAL REVIEW OF SCIENTIFIC AND TECHNOLOGICAL ASPECTS OF THE UTILIZATION OF RE MATERIALS

K. A. Gschneidner, Jr. 1972 9 p Presented at Analysis and Appl. of Rare Earth Mater. Conf., Kjeller, Norway, 23-29 Aug. 1972 Sponsored by AEC

(IS-2965; Conf-720839-1) Avail: NTIS

The major uses and some of the more promising potential applications were examined from a scientific and technological view. This led to the subdivision of these applications into four groups: those uses based on: (1) the similar chemical nature of the rare earths; (2) the 4f electrons; (3) valence states different than +3, and (4) nuclear properties. In general, the mixed rare earths are used primarily in (1) and the separated individual elements in (2), (3), and (4), although some notable exceptions are found. The scientific basis for the various applications is briefly discussed. Author (NSA)

N73-19485# Groupement Atomique Alsacienne Atlantique, Le Plessis-Robinson (France).

HYDRODYNAMIC INSTABILITY IN AN ELECTROMAGNETIC PUMP

P. M. H. Briot and J.-P. LeFrere 1972 4 p refs In FRENCH; ENGLISH summary Presented at 12th Meeting on Hydraulics, Paris, 6 Jun. 1972

(FRNC-CONF-46; Conf-720648-4) Avail: AEC Depository Libraries

A helical flow was observed in an annular induction pump conduit, which gave rise to a hydraulic instability resulting in a loss of performance at certain operating conditions. A spiral flow due to the Taylor-Goertler effect in an annular space was also studied. NSA

N73-19486# Commissariat a l'Energie Atomique, Cadarache (France). Center d'Etudes Nucleaires.

SOME ASPECTS OF HYDROSTATIC BEARINGS IN SODIUM PUMPS

X. Elie 1972 4 p In FRENCH; ENGLISH summary Presented at 12th Meeting on Hydraulics, Paris, 6 Jun. 1972

(CEA-CONF-2045; Conf-720648-16) Avail: AEC Depository Libraries

A certain number of problems arise with immersed hydrostatic shaft guide bearings in sodium pumps, mainly at high temperature operation. Experience has shown that a substantial bearing clearance is required which, in present designs, takes a considerable amount of fluid from the pumps. A new design is suggested resulting in a very appreciable reduction in the additional flow requirement, while maintaining a comparable load capacity by a hydrodynamic effect. NSA

N73-19487# Bendix Corp., Kansas City, Mo.

BEAM LEAD DEVICES AND THE HMC MANUFACTURER

R. E. Markley 1972 18 p Presented at the Mid-Am. Electron. Conf., Kansas City, Mo., 26-27 Oct. 1972

(Contract AT(29-1)-613)

(BDX-613-779; Conf-721016-2) Avail: NTIS

A process for automatically contacting, testing, and handling beam lead semiconductor devices was developed. A custom-built Teledyne TAC PS-100 Probing System interfaced to a Lorlin Impact-100 Test System provides a composite handling, contacting, and testing system for beam lead semiconductor devices which have three or less active leads. Beam lead transistors, diodes, zener diodes, SCR's, and resistors can presently be tested on this system. Beam lead devices, received in etch-separated arrays from device suppliers, can be automatically positioned, contacted, and tested at a rate of several thousand devices per hour including 100% test datalogging. Not only is device contacting and testing nondestructive, but additionally, the devices can be classified on punched tape according to test classification and XY position in the device array. Author

N73-19488# Sandia Labs., Albuquerque, N.Mex.

FABRICATION OF BORON REINFORCED MAGNESIUM COMPOSITES BY DIFFUSION BONDING OF PLASMA SPRAYED MONOLAYER TAPES

A. R. Champion and H. K. Street Sep. 1972 20 p refs Sponsored by AEC

(SC-DR-72-0677) Avail: NTIS

The technique of diffusion bonding plasma sprayed monolayer tapes was evaluated for making boron reinforced magnesium composites. Procedures were developed for plasma spraying magnesium powder, and hot pressing conditions for bonding monolayer tapes were optimized. It was found that magnesium could be sprayed in air if a coarse powder was used. The resulting matrix material had a total oxygen content of less than 1 weight percent, an ultimate tensile strength greater than 20 ksi, elastic modulus of 5.2 x 1 million psi, and an elongation of 4.9 to 6.3%. Void-free composites were obtained with no fiber degradation if temperatures of 565 to 575 C and pressures of 6000 to 8000 psi were used for the hot pressing operation. If temperature above 600 C were used, severe attack of the boron filaments occurred with an accompanying loss of strength. Author (NSA)

N73-19489# Oak Ridge National Lab., Tenn.

PLASMA ARC WELDING OF AN ISOTOPE CAPSULE

G. M. Goodwin and B. F. Early 1972 16 p refs Presented at 2d Intern. Conf. on Superalloys: Processing, Seven Springs, Pa., 18 Sep. 1972 Sponsored by AEC

(Conf-720917-1) Avail: NTIS

A certain thermoelectric generator uses a SR-90 titanate fuel form contained in a heavy walled capsule of Hastelloy C, a nickel-base alloy with excellent strength, oxidation, and corrosion properties. The capsule design uses a threaded end cap, with a closure weld to ensure containment. Based upon maximum anticipated seawater corrosion rates, a minimum weld penetration of 0.055 in. is required. A plasma arc welding procedure was developed and successfully applied to four fueled capsules, achieving an average penetration of at least twice the minimum requirement. The plasma process was found to be relatively insensitive to several of the variables which greatly affect penetration in the GTA process. Author (NSA)

N73-19490# Laboratoire Suisse de Recherches Horlogeres, Neuchatel (Switzerland).

LUBRICATION OF BALL BEARINGS UNDER VACUUM Final Report [LUBRIFICATION SOUS VIDE DE ROULEMENTS A BILLES]

H. Gass and H. E. Hintermann 31 Aug. 1972 39 p In FRENCH

(Contract ESTEC-764-69-AA)

(Rept-781-4.4; ESRO-CR(P)-146) Avail: NTIS HC $4.00

Materials for ball bearings suitable for space applications were tested. These materials included chromium steel, sintered aluminium powder, polyimides, p-oxybenzoylpolymer, silver-indium alloy, and titanium carbide. The tests were performed at both

room temperature and high vacuum. The best combination was found to be chromium steel, and Ag-60 In-40 alloy. Three other combinations are also discussed. ESRO

N73-19491# Louvain Univ. (Belgium). Inst. des Fabrications Mechaniques.
STANDARD VALUES FOR GRINDING FORCES AND SURFACE ROUGHNESS IN CYLINDRICAL GRINDING [RICHTWAARDEN VOOR SLIJPKRACHTEN ENOPPER-VLAKTERUWHEID BIJ HET CYLINDRISCH SLIJPEN] SLIJPEN]
Albert Decneut Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Dec. 1972 41 p refs In DUTCH Sponsored by IRSIA
(CRIF-MC-46) Avail: NTIS HC $4.25

Standardization values for grinding forces and surface roughness were obtained from a specially designed chipping chart. With these values, it was possible to predetermine the roughness, normal and tangential force, and the net grinding power for a random combination of diameters, approach velocity, and circumferential velocity of the grinding wheel. The influence of the values on the choice of grinding wheel is discussed. Standardization values for some difficultly grindable steels are given. ESRO

N73-19492# Defence Research Information Centre, Orpington (England).
CORROSION CAVITATION RESISTANCE OF TIN AND ALUMINIUM BRONZES
D. V. Litvak Dec. 1972 8 p refs Transl. into ENGLISH from Metalloved. i Term obrabot Metallov (Moscow), no. 1, 1972 p 26-64
(DRIC-Trans-3016) Avail: NTIS HC $3.00

The cavitation-corrosion resistance of tin and aluminum bronzes used for the manufacture of marine pumps is studied. The compositions and properties of the alloys examined are shown in a table. The studies were made with magnetostriction magnetos, with a sample vibration frequency of 8100 Hz and a double amplitude sample vibration of 30-70 mk. The tests were carried out in synthetic sea water and in distilled water, at 18 to 20 C. The results are analyzed and various conclusions are drawn.
Author (ESRO)

N73-19493# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
EXPERIMENTAL STUDY ON LOX-COOLED BEARING AND SEAL START CYCLING PERFORMANCE Final Report
Aug. 1971 80 p Prepared for Cryorocket Sponsored by ELDO (Contract Mbb Proj. 6.230.0)
(MBB-UR-84-71) Avail: NTIS HC $6.00

Results of tests under start cycling conditions on angular contact bearings and metal bellow seals filled with resin and salt impregnated carbon qualities for use in the space shuttle auxiliary propulsion system, are presented. The requirements for such an application concerning life, cycle capability, and durability of LOX cooled bearings and shaft bellow seals are very high. Multiple quick start behavior of such elements, which have already been tested under steady state conditions in the Europa 3 experimental program, was tested. The tests showed that the elements charged with more than 1000 cycles had not reached their load limit. None of the tested bearings and seals with the exception of the resin impregnated carbon ring, failed. Total test time was approximately 23,500 sec and 1,700 cycles were applied. Author (ESRO)

N73-19494# Societe Europeenne de Propulsion, Puteaux (France).
TESTS ON BEARINGS AND SEALS UNDERGOING REPEATED STARTS Final Report
J. Marugan 18 Aug. 1971 59 p Sponsored by ELDO
(SEP-NT-3058/71-M) Avail: NTIS HC $5.00

Tests on bearings and seals operating in liquid hydrogen and undergoing repeated starts are described. The operating conditions of these components in the turbopumps feeding the attitude control propulsion subsystem of the space shuttle were simulated. The bearings and seals in the test underwent 562 cycles of repeated starts and shutdowns in low load and high load conditions. Although the operating conditions were severe no major defect was found. Author (ESRO)

N73-19495# British Aircraft Corp., Weybridge (England).
ELDO SPONSORED RESEARCH ON CARBON FIBRE REINFORCED STRUCTURES Final Report
F. E. Rhodes Apr. 1972 170 p
(Contract ELDO-CTR-17/7/48)
(SOR-W-13) Avail: NTIS HC $10.50

The possibilities of applying unidirectional carbon composite reinforcement to the metal structure of a space shuttle were assessed. Two composities were evaluated, one with an epoxy matrix for use in moderate temperature regions, and the other with a polyimide matrix suitable for high temperature applications. Selected adhesives for attaching these composites were then investigated. Finally, static and fatigue tests were undertaken on a typical reinforced component. It is concluded that carbon composite reinforcement could be employed with advantage in regions where the service temperature does not exceed about 120 C. However, considerably more development work would be necessary before resin based composites could be applied in the hotter zones. Author (ESRO)

N73-19496# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REMOVING MECHANICAL IMPURITIES FROM AKOR-1 ADDITIVE BY THE FILTRATION METHOD USING AUXILIARY SUBSTANCES
I. M. Leichkis and N. G. Yampolskii 27 Oct. 1972 11 p Transl. into ENGLISH from Neftepererab. Neftekhim. (Kiev), no. 11, 1970 p 8-10
(AF Proj. 7343)
(AD-751947; FTD-HT-23-1022-72) Avail: NTIS CSCL 11/8

Studies are reported on the purification of AKOR-1 additive by the filtration method using domestically made perlite.
Author (GRA)

N73-19497# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
PROPERTIES OF PREALLOYED STEEL POWDER METALLURGY PRODUCTS Final Report
Richard E. Westerman and Kenneth R. Sump Dec. 1972 150 p refs Sponsored by Army
(AD-753325; BNW-394; SWERR-TR-72-83) Avail: NTIS CSCL 13/8

A program to evaluate the properties of prealloyed steel powders, consolidated by various fabrication techniques, was conducted. Sixteen lots of low-alloy prealloyed steel powder, representing seven different major alloys (4130, 1040, 8620, 4640, 4650, 8650, and 9450) were formed into test specimens, heat treated, and tested. Processes used to fabricate the test specimens included die press and sinter, isostatic press and sinter, not repress (limited deformation forging), and high-energy rate forming (HERF). With all fabrication procedures employed, commercial practice was closely adhered to; no attempt was made to optimize any given fabrication procedure. Tensile and impact property data, and the dependence of these values on fabrication and heat treatment parameters are presented.
Author (GRA)

N73-19498# Westinghouse Electric Corp., Cheswick, Pa. Electro-Mechanical Div.
DESIGN AND DEVELOPMENT OF A SEGMENTED MAGNET HOMOPOLAR TORQUE CONVERTER Semiannual Technical Report
C. J. Mole, F. G. Arcella, E. Berkey, D. J. Boes, and William C. Brenner Dec. 1972 41 p refs
(Contract DAHC15-72-C-0229; ARPA Order 2174)
(AD-753541; EM-4471) Avail: NTIS CSCL 13/10

The report describes research and development of a new mechanical power transmission concept; the segmented magnet homopolar torque converter. The purpose of this device is to convert unidirectional torque of constant speed (such as from a steam turbine prime mover) into variable speed output torque in either the forward or reverse directions. The concpet offers an efficient, lightweight low volume design with potential application over a wide range of speeds and power ratings in the range from hundreds to tens of thousands of horsepower. This machine

concept can be applied to commercial and military advanced concept vehicles for both terrain and marine environments. The report pertains to the initial study phase of a proposed 45 month program to design and develop this machine. In this phase all of the technical problems are being reviewed, the machinery concepts and applications are being studied, and a detailed technical plan is being evolved for the entire program.
Author (GRA)

N73-19499# Boeing Co., Renton, Wash. Commercial Airplane Group.
ROTATIONAL MOLDED PLASTIC TRICON CONTAINERS Interim Report
W. P. Benjamin, R. A. Jarmuth, H. P. Schut, and B. R. Desborough Oct. 1972 355 p
(Contract DAAK02-71-C-0201)
(AD-753344; D6-22235-2) Avail: NTIS CSCL 13/4

The document reports on a study to determine the feasibility of fabricating a full size TRICON container by encapsulating a metal structural framework with a plastic material by using the rotational molding process. The effort included a survey of commercially available rotational molding grade plastics and metals, the design and fabrication of a subscale mold and subscale containers. It was felt that a plastic encapsulated container would eliminate or minimize maintenance and repair costs of TRICON containers by reducing their susceptibility to rust, corrosion, dry rot, electrolysis, and impact damage. Materials were selected, and a subscale mold was fabricated. Techniques were developed for encapsulating a structural framework with plastic using the rotational molding process. However, stress cracks developed in the plastic after molding. Although several technical approaches were attempted, techniques for eliminating the stress cracks could not be developed. The program is being redirected toward other approaches to plastic or plastic coated containers. The report contains a body of information on molding characteristics of various rotational molding grade plastics not previously available to the plastic industry. Author (GRA)

N73-19500# Columbia Univ., New York. Lubrication Research Lab.
TIME TRANSIENT APPROACH TO THE SOLUTION OF SHAFT DYNAMICS PROBLEMS Ph.D. Thesis. Final Report
David Scranton Breed and Vittorio Castelli Jun. 1972 340 p refs
(Contract N00014-67-A-0108-0028)
(AD-754341; Rept-21) Avail: NTIS CSCL 13/9

The report presents a method for rotor dynamic analysis which has sufficient generality to treat non-linearities, time transients, steady states, dynamic responses and critical speeds for unbalanced, non-uniform shafts on any type of bearing suspension. The technique consists of integrating the transient equations forward in time. Author (GRA)

N73-19501# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRODYNAMIC DESIGN OF THRUST BEARINGS
A. S. Stolbovoi and O. B. Prikhodke 15 Nov. 1972 9 p Transl. into ENGLISH from the mono. "Razvitie Gidrodinamicheskoi Teorii Smazkii" Moscow, Izd-vo Nauka, 1970 p 65-67
(AF Proj. 7343)
(AD-753965; FTD-HT-23-1087-72) Avail: NTIS CSCL 13/9

Thrust slide bearings are designed for operating under conditions of hydrodynamic friction. The bearings have pads in the form of ring sectors and plane surface. The oil film thickness varies up to 30% and more over the radius. GRA

N73-19502# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
ADVANCES IN JOINING TECHNOLOGY: THE '60S AND BEYOND
R. M. Evans Jan. 1973 71 p refs
(Contract DSA900-73-C-0922)
(AD-754262; MCIC-73-13) Avail: NTIS CSCL 13/8

The report describes what the author believes are the most significant advancements in welding technology that have occurred since 1960. New processes that have been introduced plus significant improvements in relatively old processes are covered. The text is organized on the basis of fusion-welding, resistance-welding, solid-state welding, and brazing process characteristics. Among the fusion processes considered are plasma-arc, electron-beam, pulsed-current gas-tungsten (and gas-metal) arc, electroslag, and laser welding. Important processes discussed in the other categories include spot-weld adhesive bonding, friction welding, diffusion bonding, and explosive welding. Brazing developments are concentrated on applications of superalloys, refractory metals, titanium, and aluminum. Author (GRA)

N73-19530 Joint Publications Research Service, Arlington, Va.
USE OF PLAMYA-62 CUTTING TORCHES FOR PLATING CERAMICS
V. A. Royanov, Ye. V. Voytsekhovskiy, A. Ye. Zakharov, and V. G. Bendrik *In its* Selected Transl. in Met. 5 Feb. 1973 p 7-9 refs (For availability see N73-19528 10-17)

N73-19532 Joint Publications Research Service, Arlington, Va.
EFFECT OF ANGLE OF INCLINATION OF ELECTRODEON FORMATION OF GAS CAVITIES IN WELD ROOT DURING ARGON-ARC WELDING OF TITANIUM
I. V. Suzdalev, B. V. Kudoyarov, V. L. Russo, Yu. P. Dolgov, and E. I. Biryukov *In its* Selected Transl. in Met. 5 Feb. 1973 p 14-19 refs (For availability see N73-19528 10-17)

N73-19533 Joint Publications Research Service, Arlington, Va.
EVALUATION OF INTEGRITY OF WELDS OF AMg6 ALLOY BY PULSE WELDING
G. D. Nikiforov, Ye. A. Bulgachev, Ye. M. Lapin, and N. Ye. Cherkesov *In its* Selected Transl. in Met. 5 Feb. 1973 p 20-26 refs (For availability see N73-19528 10-17)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-19503# Defence Research Establishment Valcartier (Quebec).
SIMULATION OF A SIMPLE MODEL FOR A PARALLEL PLATE PULSED TEA LASER
J. F. Boulter Nov. 1972 34 p refs
(Proj. 97-01-20)
(DREV-TN-2054/72) Avail: NTIS HC $3.75

A preliminary model for the resistance between parallel plate gas discharge electrodes and a model for the capacitor spark discharge circuit of a pulsed TEA laser have been simulated on an EAI 8845 hybrid computer. Simulation results for the voltage, current and reciprocal resistance waveforms across the discharge electrodes have been obtained as a function of model parameters, and are compared with experimental results for a laser using pin discharge electrodes. Author

N73-19504# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
HIGH-POWER CO2 TEA LASER STUDIES
P. Oettinger Aug. 1972 26 p refs
(LRP-54/72) Avail: NTIS HC $3.50

The need for a good interferometric and light scattering plasma diagnostic radiation source has resulted in a program to construct high-power, TEA, CO2 lasers. A resistance-limited, 1.2-m long, pin-plate, plane-parallel oscillator, with a 4-cm electrode separation, has yield maximum powers of 20 MW, energies approaching 2 J, and electrical-to-radiation efficiencies near 9 percent. Optimum CO2:N2:He gas composition was found to be 1.5:1.5:7, operated at atmospheric pressure. Current pulse durations for the 60 kV discharges approximated 1 microsecond, with maximum amplitudes of 18 amperes per pin. Onset of lasing occurred near the end of the discharge with pulse half-widths of 60-150 nanoseconds. Increasing the electrode separation to 6 cm, doubling the capacitance of the system, and changing the gas composition to a 0.4-atmosphere 1:1:2 mixture, doubled the output energy. Concentric electrode configurations, using a wire cathode along the laser axis, surrounded by a cylindrical anode, lased at reduced powers, maximizing at 1.4 MW. Author

N73-19505*# General Electric Co., Philadelphia, Pa. Space Div.
AN INVESTIGATION AND CONCEPTUAL DESIGN OF A HOLOGRAPHIC STARFIELD AND LANDMARK TRACKER
Joseph D. Welch 31 Mar. 1973 104 p refs
(Contract NAS1-10739)
(NASA-CR-112143) Avail: NTIS HC $7.25 CSCL 20E

The analysis, experiments, and design effort of this study have supported the feasibility of the basic holographic tracker concept. Image intensifiers and photoplastic recording materials were examined, along with a Polaroid rapid process silver halide material. Two reference beam, coherent optical matched filter technique was used for multiplexing spatial frequency filters for starfields. A 1 watt HeNe laser and an electro-optical readout are also considered. J.A.M.

N73-19506# California Univ., Livermore. Lawrence Livermore Lab.
LLL LASER PROJECTS
G. I. Kachen, ed. and Gary Shaw, ed. Aug. 1972 9 p refs
(Contract W-7405-eng-48)
(UCRL-50022-2; Rept-2) Avail: NTIS

Two reprints from recent reports deal with laser-plasma coupling and wavelength dependence of laser-light absorption by solid deuterium. NSA

N73-19507# Central Research Inst. for Physics, Budapest (Hungary).
PERTURBATION OF ATOMIC LEVELS NEAR TO THE IONIZATION THRESHOLD IN HIGH INTENSITY LASER FIELD
J. Bakos, A. Kiss, L. Szabo, and M. Tendler Jul. 1972 8 p Presented at 7th Intern. Conf. on Quantum Elec., Montreal, Canada, 8 May 1972
(KFKI-72-42; Conf-720558-1) Avail: AEC Depository Libraries

The general multiphoton probability versus light intensity dependence of the triplet metastable He atom was measured in the case of four photon resonances very near to the ionization threshold. A big value of the Stark shift was observed. Author (NSA)

N73-19508# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands).
HOLOGRAPHIC INTERFEROMETRY IN A VIBRATING ENVIRONMENT
F. P. Kuepper and W. J. Mastop Jun. 1972 18 p refs Sponsored in part by Euratom
(NP-19480; Rept-72-70) Avail: AEC Depository Libraries

The interferometric measurement of the index of refraction of a transparent phase object with conventional interferometers is impossible if the optical paths are disturbed by vibrations of the components before or during the measurement. In the case of transient phase objects this problem can be solved by the application of holographic interferometry using a giant pulse ruby laser. That laser emits two light pulses, one before and one during the appearance of the phase object. The method is employed to detect the integral of the electron density of a plasma in a toroidal arc experiment. Author (NSA)

N73-19509# Illinois Univ., Urbana. Dept. of Electrical Engineering.
EFFECTS OF A HEAVY PARTICLE EXTERNAL IONIZATION SOURCE ON CARBON DIOXIDE LASER DISCHARGES Ph.D. Thesis
J. T. Ganley 1972 81 p refs Sponsored by AEC
(COO-2007-24) Avail: NTIS

Experiments are described which explore the effects of a heavy particle external ionization source on electrically excited CO2 laser plasmas. Effects on both longitudinal and transverse discharges have been investigated. High energy nuclear particles produced by the reaction of thermal neutrons with boron-10 served as an ionization source which was completely independent of any applied electric fields. The presence of the external ionization decoupled the electron production process from the electron heating process. The result was a pronounced change in the electrical characteristics of the discharge. In low pressure (less than 50 torr), longitudinal discharges, the external ionization has made it possible to control the discharge current and E/N independently. Conditions have thus been produced which are more favorable for laser operation than the conditions which can be produced with only an applied electric field. Under these conditions, increased laser output and efficiency have been obtained. Author

N73-19510# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF THE STUDY OF EXCITED STATE POPULATIONS IN AN EXPANDING MIXTURE TO THE MOLECULAR LASER Ph.D. Thesis - Paris Univ. [APPLICATION AU LASER MOLECULAIRE DE L ETUDE DES POPULATIONS D'ETATS EXCITES DANS UN MELANGE EN COURS DE DETENTE]
Michele Thomas-Andraud 1972 66 p refs In FRENCH; ENGLISH summary
(ONERA-NT-204) Avail: NTIS HC $5.50

The principles of a high pressure thermal laser are reviewed: a preheated and compressed N2-C02 mixture is expanded rapidly into a supersonic nozzle to obtain a population inversion of (001) and (100) carbon dioxide energy levels. The vibrational model and relaxation equations chosen to represent the various energy exchanges occurring during the expansion are discussed. A computer program was written to predict the results. An unsteady time integration method was used to express the various flow parameter evolution. The test facility and performance of its compression heater are described and experimental results are given. ESRO

N73-19511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LASER BEAM SHAPING OF ELEMENTS OF SLIDING FRICTION SUPPORTS
V. M. Suminov and Yu. i. Papyshev 17 Nov. 1972 15 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 14, no. 7, 1971 p 109-113
(AF Proj. 7343)
(AD-753490; FTD-HT-23-1219-72) Avail: NTIS CSCL 13/8

The article presents results involving the application of lasers for the production of sliding friction supports used in instrument building. Typical support designs are shown. Regression equations are presented for elements of typical sliding friction supports considering the primary factors influencing their design dimensions. The use of lasers can allow the production of an aperture or depression directly in a load bearing plate similar in shape and size to stone bearings in a single generating pulse, and also allows the formation of ends with various design characteristics on axes, while simultaneously hardening the material in the treatment zone. Author (GRA)

N73-19512# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
IR WINDOW STUDIES Quarterly Technical Report, period ending 31 Aug. 1972
John H. Marburger 29 Sep. 1972 50 p refs
(Contract F19628-72-C-0275; ARPA Order 2055)
(AD-754280; USCEE-431; QTR-1) Avail: NTIS CSCL 20/5

The initiation of a joint theoretical and experimental program on the preparation, characterization, and evaluation of IR Window Materials is reported. During this first quarter of operation, most of the activity has been design and fabrication of facilities for the program. Preliminary results regarding the characterization of point defects in CdS and CdTe by tracer self diffusion and high temperature Hall mobility techniques have been obtained. Other areas in which preliminary investigations have been carried out include closed tube chemical vapor growth of GaAs samples, measurements of thermal shock and ductility of alkali halide samples, and theoretical analyses of IR absorption mechanisms. The authors also report the completion of a general two dimensional computer code for the analysis of optical properties of IR windows. Author (GRA)

N73-19513# Army Foreign Science and Technology Center, Charlottesville, Va.
PROBLEMS OF LASER BEAM DATA TRANSMISSION; PROCEEDINGS OF THE FIRST ALL-UNION CONFERENCE
29 Nov. 1972 493 p refs Transl. into ENGLISH of the publ. "Problemy Peredachi Informatsii Lazernym Izlucheniem" Kiev,

1968 p 3-172 Conf. held at Kiev, Sep. 1968
(AD-753944; FSTC-HT-23-2015-72) Avail: NTIS CSCL 17/2

The document contains papers presented at the first conference on the problems of laser beam data transmission. The volume of research is devoted to the construction of laser information systems. However, up to this time there have been no efficiently active laser information systems. The primary cause holding back the development of efficient laser information systems is the low level of research in the field of precision physical-chemical technology of substances with small light losses and parameters which are efficiently controllable by means of electric, magnetic and acoustic fields. GRA

N73-19514# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
STIMULATED EMISSION CROSS SECTION OF Nd (3 PLUS) AT 1.06 MICROMETER IN POCl3, VAG, CaWO4, ED-2 GLASS AND LG55 GLASS Final Report, Mar. 1970 - Jun. 1971
Milton Birnbaum and Jerry A. Gelbwachs 28 Dec. 1972 22 p refs
(Contract F04701-72-C-0073)
(AD-753901; TR-0073(9230-10)-5; SAMSO-TR-72-302) Avail: NTIS CSCL 20/5

Stimulated-emission cross sections of Nd^{3+} at 1.06 micrometers in POCl3, yttrium aluminum garnet (YAG), calcium tungstate ($CaWO_4$), and two laser glasses (ED-2 and LG55) were measured by studying the laser threshold gain and inverted population. The technique of end pumping with pulsed xenon ion lasers was used with an identical laser cavity for all the Nd-doped samples. A direct comparison of the cross sections in the different hosts was obtained. Author (GRA)

N73-19515# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
CENTERLINE LASER RADIATION INTENSITY IN UNSTABLE CAVITY Final Report, Jan. - Apr. 1972
Harold Mirela and Samuel B. Batdorf 1 Sep. 1972 19 p refs
(Contract F04701-72-C-0073)
(AD-753902; TR-0073(3240-10)-2; SAMSO-TR-72-306) Avail: NTIS CSCL 20/5

The variation of laser radiation intensity along the axis of an unstable optical cavity is investigated theoretically. The present study is an extension of the work of Rigrod to situations in which geometric divergence of the radiation must be taken into account. Diffraction effects are neglected. The present results are useful for determination of the conditions under which the region near the axis is saturated. The results are also applicable for estimating transmitted intensity, near the axis, for cavities employing partially transmitting mirrors or gratings. Author (GRA)

N73-19516# Illinois Univ., Urbana. Coordinated Science Lab.
RADIATION EFFECTS IN SEMICONDUCTING LASER MATERIALS Final Report, Dec. 1968 - Aug. 1971
B. M. Arora Oct. 1972 135 p refs
(Contract F33615-69-C-1251; AF Proj. 7885)
(AD-754217; ARL-72-0087) Avail: NTIS CSCL 20/5

Contents: Spontaneous emission of pure CdSe and CdS; Stimulated emission of pure CdSe platelets; Spontaneous and stimulated emission of undoped Cd(S,Se) crystals; Effects of neutron bombardment of luminescense of CdSe; Effects of neutron bombardment of luminescense of CdSe; Effects of chemical doping and neutron bombardment of doped crystals. GRA

N73-19517# Stanford Univ., Calif. Microwave Lab.
ULTRANARROWBAND TUNABLE DYE LASER FOR NEW APPROACHES TO ATOMIC SPECTROSCOPY Technical Report, 1 Apr. - 1 Dec. 1972
Theodor W. Haensch Dec. 1972 68 p refs
(Contract N00014-67-A-0112-0071; NR Proj. 016-125)
(AD-754112; SU-ML-2130; TR-1) Avail: NTIS CSCL 20/5

The report consists of two preprints: Intensity Stabilization of Dye Laser Radiation by Saturated Amplification, a novel scheme to reduce the relative intensity fluctuations of extremely narrowband filtered dye laser radiation with a partly saturated high gain traveling wave dye laser amplifier; and Spectroscopy with Tunable Lasers, reviewing by T. W. Hansch, which will be published in the Proceedings of the Third International Conference on Atomic Physics, Boulder, Colorado, August 7-11, 1972. This paper reviews the present state of the art in the development of tunable laser sources and demonstrating the wide potential of such lasers as a research tool in spectroscopic investigations. GRA

N73-19979* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
A HIGH-EFFICIENCY, SMALL, SOLID-STATE LASER FOR PYROTECHNIC IGNITION
L. C. Yang and V. J. Menichelli *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 29-37 refs (For availability see N73-19975 10-34)
CSCL 20E

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-19518 California Univ., Davis.
SUPERPLASTICITY IN Al-Zn ALLOY: STUDIES IN MECHANICAL AND MICROSTRUCTURAL BEHAVIOR Ph.D. Thesis
Sarat Chandra Misro 1972 68 p
Avail: Univ. Microfilms Order No. 72-24608

The mechanical and microstructural behavior of the alloy was studied at the elevated temperatures under low and medium stress levels. In particular, a detailed investigation was carried out in the medium stress region of the superplastic region. The activation energies, the stress exponent n, and strain rate dependence of grain size in the two stress regions were estimated. It was found that COBLE creep and superplastic deformation are operative in low and medium stress levels respectively. The plastic deformation in the Coble region and the superplastic region is predominantly due to grain boundary sliding, evidenced from optical micrographs. Under high strain high temperature creep was evidenced by dislocation tangles (observed in transmission micrographs) and extensive subgrain formation (observed in scanning micrographs) in crept specimens. Specimens deformed superplastically showed little evidence of high dislocation density in the grains indicating the absence of severe deformation of the grain interior. Dissert. Abstr.

N73-19519 North Carolina State Univ., Raleigh.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF VACUUM ENVIRONMENT ON THE FATIGUE LIFE, FATIGUE-CRACK-GROWTH BEHAVIOR, AND FRACTURE TOUGHNESS OF 7075-T6 ALUMINUM ALLOY Ph.D. Thesis
Charles Michael Hudson 1972 165 p
Avail: Univ. Microfilms Order No. 72-24082

Axial-load fatigue-life, fatigue-crack propagation, and fracture toughness tests were conducted on 0.090-inch thick specimens made of 7075-T6 aluminum alloy. The fatigue life and fatigue-crack propagation experiments were conducted at a stress ratio of 0.02. Maximum stresses ranged from 33 to 60 ksi in the fatigue life experiments, and from 10 to 40 ksi in the fatigue-crack propagation experiments. Fatigue life experiments were conducted at gas pressures of 760, .5, .05, .0005, and 5 x 10 to the minus 8th power torr. Fatigue-crack-growth and fracture toughness experiments were conducted at gas pressures of 760 and 5 x 10 to the minus 8th power torr. The fracture surfaces of typical specimens were examined after failure using both transmission and scanning electron microscopes to study fracture modes in vacuum and air. Analysis of the results indicates that at low values of stress-intensity range, the fatigue crack growth rates were approximately twice as high in air as in vacuum. Dissert. Abstr.

N73-19520*# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.

FRACTOGRAPHIC ANALYSIS OF THE LOW ENERGY FRACTURE OF AN ALUMINUM ALLOY
J. Tanaka, C. A. Pampillo, and J. R. Low, Jr. [1972] 19 p refs
(Grant NGR-39-087-300)
(NASA-CR-131099; TR-1) Avail: NTIS HC $3.00 CSCL 11F

A study of the fracture process in a high strength aluminum alloy, 2014T6, was undertaken to identify the void nucleating particles in this material, to determine their composition, and to suggest means by which they might be eliminated without loss of strength. Author

N73-19521*# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.
AN INVESTIGATION OF PLASTIC FRACTURE IN ALUMINUM ALLOYS
J. R. Low, Jr., R. H. VanStone, and R. H. Merchant May 1972 54 p refs
(Grant NGR-39-087-003)
(NASA-CR-131100; TR-2) Avail: NTIS HC $4.75 CSCL 11F

The brittle fracture of many high strength alloys such as steel, titanium, and aluminum was shown to occur by a process called plastic fracture. According to this process microscopic voids form at impurity particles, then grow and coalesce to cause the final rupture. To further understand the role of impurities, four aluminum alloys were investigated: 2024-T851, 2124-T851, 7075-T7351 and 7079-T651. Fractography, quantitative metallography, and microprobe studies assessed the roles of various impurity particles relative to these alloys. Author

N73-19522*# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.
INVESTIGATION OF THE PLASTIC FRACTURE OF HIGH STRENGTH STEELS
T. B. Cox and J. R. Low, Jr. May 1972 45 p refs
(Grant NGR-39-087-003)
(NASA-CR-131101; TR-3) Avail: NTIS HC $4.25 CSCL 11F

An investigation of the plastic fracture process to improve tensile strength in high strength steels is presented. Two generic types of steels are considered: a quenched and tempered grade and a maraging grade, in order to compare two different matrix microstructures. Each type of steel was studied in commercial grade purity and in special melted high purity form, low in residual and impurity elements. The specific alloys dealt with include AISI 4340 and 18 Ni, 200 grade maraging steel, both heat treated to the same yield strength level of approximately 200 ksi. Author

N73-19523*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
INVESTIGATION OF THE PLASTIC FRACTURE OF HIGH STRENGTH STEELS
T. B. Cox and J. R. Low, Jr. Oct. 1972 71 p refs
(Grant NGR-39-087-003)
(NASA-CR-131102; TR-4) Avail: NTIS HC $5.75 CSCL 11F

This investigation deals in detail with the three recognized stages of plastic fracture in high strength steels, namely, void initiation, void growth, and void coalescence. The particular steels under investigation include plates from both commercial purity and high purity heats of AISI 4340 and 18 Ni, 200 grade maraging steels. A scanning electron microscope equipped with an X-ray energy dispersive analyzer, together with observations made using light microscopy, revealed methods of improving the resistance of high strength steels to plastic fracture. J.M.M.

N73-19524# Joint Publications Research Service, Arlington, Va.
SELECTED TRANSLATIONS IN METALLURGY
1 Mar. 1973 35 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (Sverdlovsk), v. 34, no. 5, 1972
(JPRS-58357) Avail: NTIS HC $3.75

Articles are presented on the electrical resistance of hydroextruded and annealed beryllium, the effect of warm rolling on the mechanical properties of unstable chromium-manganese austenitic steel, the development of martensitic conversion during deformation, and the mechanical properties of steel. For individual titles, see N73-19525 through N73-19527.

N73-19525 Joint Publications Research Service, Arlington, Va.
ELECTRICAL RESISTANCE OF HYDROEXTRUDED AND ANNEALED BERYLLIUM
I. I. Papirov, P. I. Stoyev, and I. A. Taranenko *In its* Selected Transl. in Met. 1 Mar. 1973 p 1-17 refs (For availability see N73-19524 10-17)

A study was made of the variation of the electrical resistance of hydroextruded polycrystalline beryllium in the annealing process. The study of the temperature dependence of the resistance in the temperature range below room temperature demonstrated that the increase in the specific electrical resistance for deformed beryllium by comparison with the initial resistance is (2.55 + or - 0.55) x 0.0000001 ohm-cm. The variation of the electrical resistance during annealing in the 420 to 620 C range offers the possibility of determining the activation energy of the reverse process E = 18 + or - 3 kcal/mole. On the basis of the results obtained in this experiment, the magnitude of the electrical resistance of the dislocations in the beryllium was estimated. Author

N73-19526 Joint Publications Research Service, Arlington, Va.
EFFECT OF WARM ROLLING ON THE MECHANICAL PROPERTIES OF UNSTABLE CHROMIUM-MANGANESE AUSTENITIC STEEL
I. N. Bogachev, T. D. Eysmondt, and A. V. Fugman *In its* Selected Transl. in Met. 1 Mar. 1973 p 8-17 refs (For availability see N73-19524 10-17)

A study was made of the possibility of increasing the set of mechanical properties of unstable chromium-manganese austenitic steel by deformation in the 300 to 500 C range. Along with an increase in the strength properties, the warm rolling leads to an increase in the plastic properties of the steel with active development of martensitic conversion with deformation. This is connected with stabilization of the austenite with respect to phase transformations. After warm rolling the amount of alpha-phase in the test process increases gradually with an increase in the degree of deformation, which insures good plasticity of these steels. Author

N73-19527 Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF MARTENSITIC CONVERSION DURING DEFORMATION AND THE MECHANICAL PROPERTIES OF TRIP STEEL
O. P. Maksimova, L. M. Utevskiy, and M. A. Zambrzhitskiy *In its* Selected Transl. in Met. 1 Mar. 1973 p 18-33 refs (For availability see N73-19524 10-17)

A study was made of the interrelation of martensitic conversion during deformation and the structure and mechanical properties of trip steel having different inclination toward the formation of deformation martensite. The effect of the warm work hardening and the test temperature on the capacity for conversion, the structure, and mechanical characteristics of trip steel were investigated. Descriptions are made of the characteristic features of the fine structure of this steel explaining the causes of severe hardening during warm work hardening of austenite, and the increase in the strain hardening coefficient during subsequent tensile testing. Author

N73-19528# Joint Publications Research Service, Arlington, Va.
SELECTED TRANSLATIONS IN METALLURGY
N. G. Pospelov, V. A. Royanov, and D. M. Bobrishchev-Pushkin 5 Feb. 1973 28 p refs Transl. into ENGLISH from Svarochn. Proizv. (Moscow), no. 11, 1972 p 22-23, 34-35, 43-48
(JPRS-58148) Avail: NTIS HC $3.50

Five articles on the effect of order of welding and heat treatment operations are presented. For individual titles, see N73-19529 through N73-19533.

N73-19529 Joint Publications Research Service, Arlington, Va.
EFFECT OF ORDER OF WELDING AND HEAT TREATMENT OPERATIONS ON MECHANICAL PROPERTIES OF THIN SHEET WELD JOINTS OF N18K9M5T STEEL
N. G. Pospelov, M. I. Samoylov, G. A. Beresnev, and G. L. Gubin *In its* Selected Transl. in Met. 5 Feb. 1973 p 1-6 refs (For availability see N73-19528 10-17)

Results are presented of investigations on the effect of the order of welding operations and types of heat treatment on the

mechanical properties of weld joints of N18K9M5T steel. After welding, the plates were subjected to special local heat treatment (austenitizing and thermal cycling) with high frequency currents using a hardening inductor. It was concluded that: (1) The uniaxial tensile strength and plasticity of weld joints not hardened by aging and the base metal are practically the same. (2) In welded plates, heat treated after welding, the strength and plasticity are substantially higher if aging is preceded by hardening. (3) Thermal cycling of a weld joint before hardening and aging increased its mechanical propreties to the level of the base metal. F.O.S.

N73-19530 Joint Publications Research Service, Arlington, Va.
USE OF PLAMYA-62 CUTTING TORCHES FOR PLATING CERAMICS c15
V. A. Royanov, Ye. V. Voytsekhovskiy, A. Ye. Zakharov, and V. G. Bendrik *In its* Selected Transl. in Met. 5 Feb. 1973 p 7-9 refs (For availability see N73-19528 10-17)

The Plamya-62 acetylene cutting torch was investigated for use in spraying ceramic materials. The dimensions of the mixing chamber, injector, and mixture discharge nozzle of the torch are described along with the procedures and types of powders used in the spraying tests. The capability of using mass produced Plamya-62 acetylene cutting torches for coating ceramic materials was demonstrated. For gas spraying high-temperature ceramics, it is recommended that a mixture consisting of ceramic powder containing 4 to 8% metal additives be used. F.O.S.

N73-19531 Joint Publications Research Service, Arlington, Va.
HEALTH EVALUATION OF ELECTRON BEAM WELDING OF BERYLLIUM BRONZE c04
D. M. Bobrishchev-Pushkin, L. A. Naumova, and N. A. Khelkovskiy-Sergeyev *In its* Selected Transl. in Met. 5 Feb. 1973 p 10-13 refs (For availability see N73-19528 10-17)

Procedures for reducing health hazards involved in welding beryllium alloys using electron beams were studied. It was found that the greatest amount of beryllium precipitated on the top wall of the welding chamber, and that the best way to remove the deposit is to dissolve it in 5% HCL followed by drying with alcohol. It is recommended that electron beam welding machines be equipped with special local exhaust ventilation. F.O.S.

N73-19532 Joint Publications Research Service, Arlington, Va.
EFFECT OF ANGLE OF INCLINATION OF ELECTRODEON FORMATION OF GAS CAVITIES IN WELD ROOT DURING ARGON-ARC WELDING OF TITANIUM c15
I. V. Suzdalev, B. V. Kudoyarov, V. L. Russo, Yu. P. Dolgov, and E. I. Biryukov *In its* Selected Transl. in Met. 5 Feb. 1973 p 14-19 refs (For availability see N73-19528 10-17)

A hypothesis is proposed for the formation of gas cavities during arc welding. Factors that influence the formation of gas cavities in the weld root are considered to be the force action of the arc on the welded metal; thermal action of the arc on the welded metal; and thermal and force action acting simultaneously. A nomogram showing the formation of gas cavities during welding with the electrode in forward angle, perpendicular, and backward angle is presented along with a nomogram showing the dependence of depth of fission on welding current and speed. It is concluded that welding with a forward angle doubles or triples the maximum welding speed of T-joints of titanium with a nonconsumable electrode in argon. F.O.S.

N73-19533 Joint Publications Research Service, Arlington, Va.
EVALUATION OF INTEGRITY OF WELDS OF AMg6 ALLOY BY PULSE WELDING c15
G. D. Nikiforov, Ye. A. Bulgachev, Ye. M. Lapin, and N. Ye. Cherkesov *In its* Selected Transl. in Met. 5 Feb. 1973 p 20-26 refs (For availability see N73-19528 10-17)

The flaws were studied that form in the seam metal during argon-arc pulse welding with tungsten electrodes, due to release of hydrogen in the decomposition of absorbed moisture in particles of oxide films in the weld bath. The high pressure of the molecular hydrogen leads to displacement of uncrystallized eutectic alloys, and the formation of branched channels. Microcracks and tears form when the metal is in the brittle temperature range. The effects of pulse and pause duration on the number and distribution of leaks are discussed along with the effects of spot steps. It is concluded that for short pulse duration the leaks are located in the zone of maximum crystallization rates; for long pulse duration they are located in the zone of thermal influence in the preceding spot; and the number of leaks decreases as pause duration and the spot step are decreased. F.O.S.

N73-19534# Pisa Univ. (Italy). Ist. di Macchine.
MHD SYSTEM OF LIQUID METALS [SISTEMI MHD A METALLO LIQUIDO]
R. Chiavaccini Jan. 1972 36 p refs In ITALIAN
(LM-MHD-1) Avail: NTIS HC $4.00

Maximum analysis of the liquid metal magnetohydrodynamics of various systems was made with emphasis on the thermodynamic cycles. Several schemes for the LM-MHD are developed based on two phase flow: a liquid metal, as the working fluid, and a vapor as the thermodynamic fluid. Transl. by F.O.S.

N73-19535# Atomic Energy of Canada Ltd., Chalk River (Ontario). Nuclear Labs.
ELECTRON PROBE MICROANALYSIS OF BONDS BETWEEN TITANIUM OR NICKEL AND TITANIUM ALLOYS
R. W. Gilbert Jun. 1972 20 p refs
(AECL-4251) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $0.50

As part of a seal development program, attempts were made to bond a ductile metal (Ni or Ti) to a titanium alloy disc. Metallography showed segregates and intermetallics at the bond zones. Electron probe microanalysis identified various phases in specimens subjected to different bonding treatments.
Author (NSA)

N73-19536# Liege Univ. (Belgium).
CRITICAL STUDY OF BER AND FRIEDMAN THEORY. PROLONGATION OF THE THEORY [ETUDE CRITIQUE DE LA THEORIE DE BER ET FRIEDMAN. PROLONGEMENTS DE LA THEORIE]
Leon Rutten 1971 213 p ref In FRENCH
Avail: NTIS HC $12.75

Extensions were made to the Ber and Friedman theory of elasticity in materials to cover pressure distribution effects on wear in metallic tools and life of such tools. Formulas were proposed and verified for determining inflection points and calculating wear of tool parts subjected to continuous pressure.
Transl. by E.H.W.

N73-19537*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME POSSIBLE FILLER ALLOYS WITH LOW VAPOR PRESSURES FOR REFRACTORY-METAL BRAZING
James F. Morris Feb. 1973 24 p refs
(NASA-TM-X-68190; E-7328) Avail: NTIS HC $3.50 CSCL 11F

A compilation of eutectics and melting-point minima for binary combinations of metals having vapor pressures below 10 to the minus 10th power torr at 1500 degrees K and .00005 torr at 2000 degree K is presented. These compositions and others near them on their phase diagrams are potential special brazing fillers for refractory metals. Some possible problems and advantages for fusion bonds of such mixtures are indicated. Evaluations of brazing fillers containing refractory metals are reported. Author

N73-19538# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
PRODUCTION, QUALITY CONTROL, AND APPLICATIONS OF PURE RE METALS AND ALLOYS
K. A. Gschneidner, Jr. 1972 10 p refs Presented at Analysis and Appl. of Rare Earth Mater. Conf., Kjeller, Norway, 23-29 Aug. 1972 Sponsored by NASA
(IS-2968; Conf-720839-4) Avail: NTIS

The light lanthanide metals are usually prepared by the metallothermic reduction method using Ca or Li, or by the electrolytic method. Yttrium and the heavy lanthanides are prepared only by the Ca or Li reduction method. The volatile lanthanides, Sm, Eu, Tm, and Yb are prepared by the La reduction of the oxide. Misch-metal, primarily because of economic reasons, is prepared electrolytically. The quality control with respect to the production of high purity rare earth metals is discussed. The

important metallurgical uses of the rare earths are examined, and the reasons for the utilization are noted. Author (NSA)

N73-19539# Aerojet Nuclear Co., Idaho Falls, Idaho.
COMPARISON OF THE FATIGUE AND CREEP FATIGUE PROPERTIES OF UNIRRADIATED AND IRRADIATED TYPE 304 AND 316 STAINLESS STEEL AT 593 C (1100 F)
C. R. Brinkman, G. E. Korth, and J. M. Beeston Aug. 1972 50 p refs
(Contract AT(10-1)-1375)
(ANCR-1078) Avail: NTIS

Results from fully reversed strain-controlled fatigue tests conducted at 593 C with and without tensile hold times on irradiated and unirradiated AISI 304 and 316 stainless steel are reported. Corresponding data from constant strain rate tensile tests conducted at the same temperature and strain rate are also given. Comparing data obtained from tests conducted on unirradiated Type 316 stainless steel in either the solution annealed or solution annealed and aged condition showed that aging was beneficial in improving both the fatigue and creep-fatigue properties at this temperature. An indication was found that unirradiated Type 304 stainless steel would be more suitable for applications involving creep-fatigue interaction than unirradiated Type 316 stainless steel. Author

N73-19540# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
EFFECT OF ANNEALING ON THE SUBSTRUCTURE OF COLD WORKED FCC METALS AND ALLOYS Progress Report, 1 Sep. 1971 - 1 Sep. 1972
D. E. Mikkola 1972 28 p refs
(Contract AT(11-1)-1431)
(COO-1431-14) Avail: NTIS

An effort was made to obtain information about annealing processes through quantitative examination of structural changes with X-ray diffraction and transmission electron microscopy and to relate the changes in structure to changes in properties. Semi-quantitative expressions were developed relating the substructure of explosively loaded and partially annealed Cu 8.5 at. percent Ge to its strength. A model was developed to account for the kinetics of particle size growth during annealing of the same alloy. The nature and stability of the substructure in cold-rolled Cu 8.5 at. percent Ge was established and the data were compared to results for the same alloy deformed by explosive loading and filing. Both the nature and stability of the substructures were found to be dependent on the mode of deformation. Preliminary work was carried out on the changes in substructure and annealing behavior caused by adding small amounts of solute to pure Cu. Author

N73-19541# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
SUBSTRUCTURE OF EXPLOSIVELY LOADED Cu-8.5 AT. PCT. Ge AND ITS RELATION TO HARDNESS
D. J. Borich and D. E. Mikkola Sep. 1972 29 p refs Submitted for publication
(Contract AT(11-1)-1431)
(COO-1431-15) Avail: NTIS

The shock induced defect microstructure in Cu-8.5 at. pct. Ge has been studied with X-ray diffraction. Samples of the alloy were explosively loaded at 100, 180, 350, and 475 kbars with planar shock waves using the driver plate technique. Complete analysis of the X-ray diffraction effects was made on each sample along with measurements of the changes in microhardness and electrical resistivity. The effective particle size decreased in a regular manner with shock pressure. Similarly, the rms microstrains, stacking fault probability, and twin fault probability increased with shock pressure. The twin fault probability was four times as large as the stacking fault probability. Generally, the substructure was more isotropic at higher shock pressure. Semiquantitative relationships have been developed relating the microhardness to the dislocation density and to the various substructure parameters. Author

N73-19542# Iowa State Univ. of Science and Technology, Ames.
THERMODYNAMIC PROPERTIES OF LIQUID METALS BY LANGMIUR VAPORIZATION TECHNIQUES
K. L. Walter and F. D. Stevenson 1972 19 p refs Presented at 65th Ann. Meeting of the Am. Inst. of Chem. Engr., New York, 26 Nov. 1972 Sponsored by AEC
(IS-2871; Conf-721106-3) Avail: NTIS

Practical solutions are reported to the difficult experimental problems associated with Langmuir vaporization of liquid lead. Vapor pressures, heats of vaporization and extropies of vaporization are in excellent agreement with recent Knudsen and torsion effusion data. Use of the Langmuir method to measure partial pressures of lead over liquid indium-lead alloys and thereby obtain associated thermodynamic solution properties was unsuccessful, apparently because of depletion of lead at the vaporizing surface. The reduction in the maximum vaporization rate caused by differing visual amounts of surface oxide in preliminary trials is indicated. Author

N73-19543# Addis Translations International, Woodside, Calif.
X-RAY TOPOGRAPHY OF URANIUM ALLOYS
Lucien LeNaour Feb. 1972 45 p refs Transl. into ENGLISH from the French report CEA-R-3494 Prepared for Sandia Labs., Albuquerque, N. Mex. Sponsored by AEC
(SC-T-72-2467; CEA-R-3494) Avail: NTIS

Interpretation of X-ray images is complicated by the complexity of the diffraction spectra of uranium alloys. Characterization by quantitative parameters such as the grain size or subgrain size and size distribution, mutual disorientations, and whether these are continuous or discontinuous is described. These diffraction processes constitute an interesting means of investigating many features of the microstructure that exercise a close control upon the behavior of the material examined under irradiation. Author

N73-19544# Cornell Univ., Ithaca, N.Y.
GRAIN BOUNDARY DISLOCATIONS AND LEDGES
J. P. Hirth and R. W. Balluffi 27 Sep. 1972 47 p refs
(Contract AT(11-1)-3158)
(COO-3158-12) Avail: NTIS

Models for line defects in grain boundaries are reviewed. The structures of grain boundary dislocations (GBD's) and ledges are examined, and line defects which correspond to either pure GBD's, pure grain boundary ledges or else defects possessing both dislocation and ledge character are distinguished. The concept of impotent grain boundary dislocations (IGBD's) is introduced, and circuits are defined which yield the Burgers vectors of both GBD's and IGBD's. Two distinct types of circuits are found to be useful and are described. Virtual grain boundary dislocations (VGBD's) are also considered. What have been called VGBD's are shown in some cases to be true GBD's. GBD's formed in grain boundary cutting or impingement processes are found to be identical to secondary GBD's in boundaries of near coincidence orientation. Generalized secondary GBD's are found to represent an intermediate representation between the Frank model and the surface dislocation model. Author

N73-19545# Maryland Univ., College Park.
INVESTIGATION OF IRRADIATION STRENGTHENING OF BCC METALS AND SOLID SOLUTIONS Progress Report, Jan. - Oct. 1972
R. J. Arsenault Oct. 1972 236 p refs
(Contract AT(40-1)-3612)
(ORO-3612-9) Avail: NTIS

Research and development progress is reported in appendixes on radiation effects on Mo single crystals, dislocation channeling in irradiated V, annealing effects on irradiated interstitial V alloys, anneal hardening of reactor materials, dislocation motion in metals and alloys, thermally activated deformation, and yield behavior of V. A separate abstract was prepared for each of two appendixes. NSA

N73-19546# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERGRANULAR DEFORMATION IN THE CREEP OF PLATINUM-RHODIUM ALLOYS
I. I. Novikov, F. S. Novik, E. I. Rytvin, S. S. Prapor, and L. P. Shipulina 24 Nov. 1972 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (USSR), no. 3, 1969 p 140-143
(FTD Proj. T65-09-17A)
(AD-753508; FTD-HT-23-1627-72) Avail: NTIS CSCL 11/6

Using standard Pt alloys with 7, 10, and 15% Rh, the authors investigated the contribution, during creeping, of intergranular deformation to total specimen elongation at temperatures of 1350, 1400, and 1500 degrees and stresses of 0.2, 0.5, and 1.3 kg/sq mm In all cases, intergranular deformation was found to be significantly less pronounced than overall specimen elongation, with its contribution to total elongation decreasing inversely to creep time. During the steady-state creep stage the relative grain displacement vector is directly proportional to both overall and intergranular deformation. Author (GRA)

N73-19547# Naval Postgraduate School, Monterey, Calif.
ELASTIC CONSTANTS OF POLYCRYSTALLINE VANADIUM-IRON ALLOYS Ph.D. Thesis
John Donegan, Jr. Sep. 1972 61 p refs
(AD-753615) Avail: NTIS CSCL 11/6

Polycrystalline alloys of iron in vanadium up to 15.32 atomic percent were prepared principally by arc melting. In order to obtain the elastic constants and investigate the possibility of the existence of an elastically isotopic alloy ultrasonic measurements were made. These measurements determined the longitudinal and transverse wave velocities in the 10-30 MHz range at room temperature. The resulting longitudinal modulus increased with alloying whereas the shear modulus remained roughly constant although the data are somewhat scattered. These data are interpreted to show that the shear constants vary through alloying in a manner consistent with the results of other experiments and that the results are consistent with an s(1) d(n 1) electronic configuration in the transition metals. The existence of an isotropic alloy is indicated for alloys with electron to atom ratios lower than vanadium rather than for the alloys measured. Author (GRA)

N73-19548# Brown Univ., Providence, R.I. Div. of Engineering.
A LITERATURE SURVEY OF THE COMBINED EFFECTS OF STRAIN RATE AND ELEVATED TEMPERATURE ON THE MECHANICAL PROPERTIES OF METALS Final Technical Report, Oct. 1971 - Jun. 1972
Abdel-Salam M. Eleiche Sep. 1972 131 p refs
(Contract F33615-71-C-1308; AFML-TR-72-125)
(AD-754243; AFML-TR-72-125) Avail: NTIS CSCL 11/6

The report is a survey of the available literature on the observed effects of strain rate on the mechanical properties of metals at elevated temperatures. The range of strain rates included in this survey is from 0.0001/sec to 0.001/sec, and the range of temperatures from room temperature up to the melting point. The compiled data and the reference sheets should be useful as a quick reference on the experimental investigations carried out to date in this field, as well as a source for quantitative information on the rate dependence of the mechanical properties of metals at elevated temperatures. Author (GRA)

N73-19549# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A TEST PROCEDURE TO EVALUATE THE RELATIVE SUSCEPTIBILITY OF MATERIALS TO STRESS CORROSION CRACKING Research Report, Jun. 1971 - Mar. 1972
Dennis L. Dull and Louis Raymond 29 Dec. 1972 40 p refs
(Contract F04701-72-C-0073)
(AD-754205; TR-0073(3250-10)-3; SAMSO-TR-72-298) Avail: NTIS CSCL 11/6

A stress corrosion test procedure that employs electrochemical potentiostatic polarization techniques has been presented. A potentiostatic stress corrosion life curve (PSCLC) was developed for various materials. The PSCLC can be used to show the effect of galvanic coupling on stress corrosion cracking. The best material for resistance to stress corrosion cracking can be determined by superimposing the PSCLC for each specific material and then partitioning the specific potential range. Also, the orders of magnitude scatter band that are observed in time-to-failure data are explained by this test procedure. The time to failure has been shown to be dependent on the electrochemical potential that exists between the environment and the material. This potential dependency on SCC has not been accounted for in stress corrosion testing. Author (GRA)

N73-19550# Battelle Columbus Labs., Ohio.
RESEARCH ON METALLURGICAL SYNTHESIS Technical Report, 15 Jun. 1971 - 30 Jun. 1972
B. A. Wilcox, G. T. Hahn, and R. I. Jaffee Dec. 1972 122 p refs
(Contract F33615-71-C-1679)
(AD-753910; AFML-TR-72-238) Avail: NTIS CSCL 11/6

Contents: Microstructural synthesis in combined precipitation hardened-dispersion strengthened (PH-DS) aluminum alloys; Synthesis of dispersion strengthened titanium alloys by attritor milling; Evaluation of new high temperature titanium alloys; Vapor deposition of metals on aluminum and boron; Evaluate refractory oxide crucible material for induction melting of titanium; Low temperature mechanical treatments to enhance formability of titanium alloys. Author (GRA)

N73-19551# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SOLID SOLUTION STRENGTHENING AND FUNDAMENTAL DESIGN OF TITANIUM ALLOYS Technical Report, Jul. 1970 - Aug. 1972
E. W. Collings, H. L. Gegel, and J. C. Ho Sep. 1972 55 p refs
(AF Proj. 7353)
(AD-754240; AFML-TR-72-171) Avail: NTIS CSCL 11/6

Phase stabilization and solid solution strengthening in titanium alloys are discussed from an electronic viewpoint. Based on the structure dependence of cohesive energy, we rationalize the alpha and beta-stabilization of titanium as produced by alloying with nontransition and transition metals, respectively; and point out that only the addition of alpha-stabilizers will yield significant strengthening effect. The preference of multicomponent alloying, i.e., adding several nontransition metal solutes to titanium or otherwise beta-stabilized alloys, can also be justified from the concept to be described. Correlations between physical and mechanical properties of prototype systems (Ti-Al, Ti-Ga, Ti-Sn, Ti-Al-Ga, Ti-Mo, and Ti-Mo-Fe-Al) are presented to demonstrate the validity of the fundamental approach, which should eventually develop into useful alloy design criteria. Author (GRA)

N73-19552# Brown Univ., Providence, R.I. Engineering Materials Research Lab.
THE EFFECT OF THE INTERMEDIATE PRINCIPAL STRESS ON TRIAXIAL FATIGUE OF 7075-T6 ALUMINUM ALLOY
W. N. Findley and J. F. Tracy Oct. 1972 10 p refs
(AD-754414; MRL-E-86; EMRL-54) Avail: NTIS CSCL 11/6

Fatigue tests of 7075-T6 aluminum alloy under synchronous pulsating triaxial stresses were performed with three different values of the intermediate principal stress. Thick-walled tubes were subjected to internal pressure pulse axial stress such that the state of stress at the inner surface was as follows: in the first case the intermediate principal stress was a compression equal to the internal pressure; in the second it was a tension equal to the internal pressure; and in the third it was a tension equal to the hoop stress at the inner surface. Results showed no effect of the intermediate principal stress. Author (GRA)

N73-19553# Dayton Univ. Research Inst., Ohio. Research Inst.
FATIGUE CRACK GROWTH RETARDATION AFTER SINGLE-CYCLE PEAK OVERLOAD IN Ti6Al-4V TITANIUM ALLOY Final Report, Apr. - Dec. 1971
Raymond E. Jones Apr. 1972 54 p refs
(Contract F33615-71-C-1054)
(AD-753899; AFML-TR-72-163) Avail: NTIS CSCL 11/6

Fatigue crack growth after single-cycle peak overload was investigated in Ti-6Al-4V sheet. Strain hardening was determined not to be the major controlling mechanism retarding crack growth after peak overload, but instead, strain hardening slightly accelerated crack growth for the case when strain hardening was induced prior to crack initiation. Crack growth after peak overload was characterized by: (1) no effect after 20 percent overload (a 20 percent increase in maximum stress intensity); (2) crack arrest immediately following 70 and 100 percent overloads; (3) subsequent retarded crack growth rates after 70 and 100 percent overloads; and (4) retardation but no arrest following 50 percent overload. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-19554 National Lending Library for Science and Technology, Boston Spa (England).
HEAT-RESISTANT ELECTRICAL INSULATING PAPERS BASED ON INORGANIC FIBERS
K. V. Breitveit and E. A. Chaikina Nov. 1972 10 p refs Transl. into ENGLISH from Elektrotekhnika (Moscow), v. 5, 1972 p 22-24
(NLL-RTS-7740) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.90; 3 NLL photocopy coupons

This article describes features of the production and properties of heat resistant electrical insulating papers based on various asbestos fibers and artificial inorganic fibers such as quartz, silica, ceramics of kaolin, and others. Asbestos is shown to be the most feasible, and studies are made of its tensile, electrical, and mechanical strength when reinforced with binders. It was found that asbestos fibers impregnated with resins yield a viable substitute for glass fiber laminates. J.M.M.

N73-19555 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A STUDY OF THE MICROSTRUCTURE AND OPTICAL PROPERTIES OF THIN LEAD-DIELECTRIC CERMET FILMS Ph.D. Thesis
Robert Barry Owen 1972 171 p
Avail: Univ. Microfilms Order No. 72-24456

A transmission electron microscopy study involving direct and replicating techniques is directed to a definition of the microstructure of radio-frequency-sputtered, thin lead-dielectric cermet films. Once defined, this microstructure is used to obtain theoretical film refractive indices. The Maxwell Garnet theory provides a basis for the theoretical results. Measurements of film transmission and reflectivity are used to obtain rough experimental values for film refractive indices by the Tekucheva method. More exact values are obtained via ellipsometry. The rough Tekucheva values are used to determine the range over which computer calculations interpreting the ellipsometric results must be made. This technique yields accurate values for the film refractive indices. Dissert. Abstr.

N73-19556*# Stanford Research Inst., Menlo Park, Calif.
DETERMINATION OF CONTAMINATION CHARACTER OF MATERIALS IN SPACE TECHNOLOGY TESTING Summary Report, 22 Apr. 1970 - 30 Jun. 1971
Daniel L. Haynes 30 Jun. 1971 71 p
(Contract NAS5-11697; SRI Proj. PSU-7907)
(NASA-CR-122374; Rept-2) Avail: NTIS HC $5.75 CSCL 11D

The contamination characters of selected materials used in space technology testing. Specific materials were subjected to a thermal vacuum environment, and the outgases were collected on a cold test mirror surface. Approximately one-half of the surface of the mirror was subjected to ultraviolet irradiation while the outgases were being deposited on the mirror. The purpose of these experiments was to determine the effect of ultraviolet irradiation on the contaminative character of outgases from selected materials. The degree of contamination was measured in terms of degradation of the optical properties of the test mirror and the amount of deposit per unit area on quartz crystal microbalances placed near the test mirror, and by means of quadrupole mass spectral measurements of outgases from the test samples. Author

N73-19557# Lockheed Missiles and Space Co., Palo Alto, Calif.
ESTIMATE OF THE HEAT RESISTANCE OF GRAPHITES IN A BROAD TEMPERATURE RANGE
D. A. Trapeznikov, Iu. P. Anufriev, D. V. Kochetov, N. S. Laukhina, and V. A. Ursin [1972] 6 p refs Transl. into ENGLISH from Probl. Prochnosti (USSR), no. 9, 1972 p 18-21
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An analysis was made of heat-stress, ultimate states under thermal loading, and temperature dependence of heat resistance for five brands of graphite. The five graphites, Vpp, Vpp-1000, MPG-8, ARV, and PROG-2400 differ in their production technology, structure, and fundamental mechanical thermophysical characteristics. Author

N73-19558*# Avco Corp., Lowell, Mass. Systems Div.
DEFORMATION PROCESSES IN FORGING CERAMICS
R. M. Cannon and W. H. Rhodes Feb. 1973 53 p refs
(Contract NASw-2187)
(NASA-CR-131109) Avail: NTIS HC $4.75 CSCL 11B

The deformation processes involved in the forging of refractory ceramic oxides were investigated. A combination of mechanical testing and forging was utilized to investigate both the flow and fracture processes involved. Deformation studies of very fine grain Al2O3 revealed an apparent transition in behavior, characterized by a shift in the strain rate sensitivity from 0.5 at low stresses to near unity at higher stresses. The behavior is indicative of a shift in control between two dependent mechanisms, one of which is indicated to be cation limited diffusional creep with significant boundary enhancement. The possible contributions of slip, indicated by crystallographic texture, interface control of the diffusional creep and inhomogeneous boundary sliding are also discussed. Additional experiments indicated an independence of deformation behavior on MgO doping and retained hot pressing impurities, at least for ultrafine grained material, and also an independence of test atmosphere. Author

N73-19559# Sandia Labs., Albuquerque, N.Mex.
EFFECT OF FABRICATION CONDITIONS ON THE MECHANICAL PROPERTIES OF BERYLLIUM-ALUMINUM COMPOSITES
R. H. Ericksen Sep. 1972 18 p refs Sponsored by AEC
(SC-DR-72-0731) Avail: NTIS

The effect of fabrication conditions on the mechanical properties of Be-Al monolayer tape and composite specimens fabricated from several different lots of beryllium wire was investigated. Properties of the beryllium filaments, particularly the ductility, varied with heat treatment and the changes in ductility were not the same for each filament lot. Testing of monolayer tape specimens was shown to be useful in minimizing the number of test conditions required to determine composite fabrication parameters. It was also shown that ductile Be composites could be fabricated by short time hot pressing followed by an auxiliary high temperature heat treatment. The Be-Al composite stress-strain curves exhibited a yield point, an observation not previously reported. A Luders band front passed through the composite during the yield point elongation and the front velocity was measured to be 0.01 + or - 0.003 in./sec. The yield point phenomenon was also observed in the filaments and a synergistic interaction with the matrix produced the composite yield point behavior. Author (NSA)

N73-19560# Marquette Univ., Milwaukee, Wis. Coll. of Engineering.
THERMODYNAMIC STUDY OF NONSTOICHIOMETRIC CERIUM DIOXIDE
R. J. Panlener and R. N. Blumenthal 1972 34 p refs Sponsored by AEC
(COO-1441-18) Avail: NTIS

Thermogravimetric measurements were performed on nonstoichiometric cerium dioxide in the temperature range from 700 to 1500 C and from oxygen pressures of one tenth to ten to the minus twenty-sixth power atmospheres. From this data the deviation from stoichiometry was determined. The thermodynamic quantities delta H02 and delta S02 were calculated in the region between 0.0003 and 0.3 and found to be independent of temperature. The conditions existing in various composition regions are presented. It is concluded that the variations experienced in the composition ranges are caused by increasing defect interaction with increasing departures from stoichiometry. Author

N73-19561# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
MISCELLANEOUS USES OF RE MATERIALS (CERAMICS, GLASSES, NUCLEAR APPLICATIONS, ET CETERA)
K. A. Gschneidner, Jr. 1972 13 p refs Presented at Analysis

and Appl. of Rare Earth Mater. Conf., Kjeller, Norway, 23-29 Aug. 1972 Sponsored by AEC
(IS-2967; Conf-720839-3) Avail: NTIS

The more important commerical uses of the rare earth elements in ceramics, glasses, and the nuclear area are described. Several other (miscellaneous) applications, which are not included in the various categories reviewed at the Conference, have been noted and discussed. A few unusual uses are also mentioned in the four categories reviewed. (37 references) Author (NSA)

N73-19562# Sandia Labs., Albuquerque, N.Mex.
DEVELOPMENT OF A BORSIC ALUMINUM COMPOSITE RING STIFFENER
W. R. Hoover, R. E. Allred, and D. M. Schuster Sep. 1972 35 p refs Sponsored by AEC
(SC-DR-72-0706) Avail: NTIS

The feasibility of fabricating of thick-walled, Borsic filament-reinforced aluminum alloy ring for use as a stiffener in the 155 mm artillery fired atomic projectile has been demonstrated and is described. The ring stiffener, which fits in the steel bulkhead under the rotating band, was produced by simultaneous circumferential filament winding and plasma spraying followed by axial compaction. Both static testing and actual gun firing confirmed that the composite ring can withstand the severe stress environment required, while effectively stiffening the projectile and producing a significant weight saving. Author (NSA)

N73-19563# Oxford Univ. (England). Engineering Lab.
THE EFFECT OF DYNAMIC LOADING ON THE MECHANICAL PROPERTIES OF GLASS-REINFORCED PLASTICS (A PRELIMINARY SURVEY USING THE SPLIT HOPKINSON BAR PUNCH TESTING MACHINE) Interim Report, Jul. 1972
J. Harding Jul. 1972 59 p refs
(Contract N/CP/75/52575/65/SC334)
(Rept-1042/72; IR-5) Avail: NTIS HC $5.00

Punch load-displacement curves are presented for tests at mean punch velocities in the range 10.00005 to 1000 in./s on specimens of two thicknesses cut from a 3/8 in plate of glass-reinforced plastic material, and on specimens of the full-plate thickness cut from a special 0.08 in. two-ply laminate. In each series of tests a considerable experimental scatter was found both in the measured loads and in the general shape of the load-displacement curves. This behavior is thought to be the result of large inhomogeneities within the specimen material. Also a marked effect of strain rate on the maximum punch load was apparent. A further series of tests was undertaken using a Permaglass-22 laminated woven glass sheet particularly chosen for the homogeneity of its structure and the regularity of distribution of its glass fiber reinforcement. Results showed a much reduced experimental scatter. For the latter test load-displacement curves are presented for mean punch velocities in the range 0.00005 to 630 in./s. Author

N73-19564# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILIZATION OF HIGH PRESSURE POLYETHYLENE BY NEW ANTIOXIDANTS: PRODUCTS OF THE CYCLOALKYLATION OF PHENOL AND o-, m-, AND p-CRESOLS AND 1, 2-DIHYDRONAPHTHALENE
S. F. Naumova, M. V. Balykina, and Ye. N. Artsimenya Nov. 1972 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 15, no. 4, 1971 p 325-327
(AF Proj. 7343)
(AD-753479; FTD-HT-23-1096-72) Avail: NTIS CSCL 11/9

The product of cycloalkylation of phenol, o-cresol, m-cresol, and p-cresol by 1,2 dihydronaphthalene are recommended as antioxidants for stabilizing high pressure polyethylene.
Author (GRA)

N73-19565# Ohio State Univ. Research Foundation, Columbus.
DEGRADATION MECHANISMS OF PIGMENTED COATINGS Final Report, 1 Jan. 1971 - 30 Aug. 1972
William B. Campbell and Joe K. Cochran, Jr. Oct. 1972 88 p refs
(Contract F33615-71-C-1257; AF Proj. 7342)
(AD-753410; AFML-TR-71-42-Pt-2) Avail: NTIS CSCL 11/3

Oxygen transport in polymonomethylsiloxane was investigated and compared to polydimethylsiloxane properties. The effects of rutile pigmentation on the permeability, diffusion, and solubility of oxygen through polymonomethylsiloxane were investigated. Permeability and diffusion constants decreased with increasing pigment concentration and there was no evidence of oxygen sorption on the pigment. Relative adhesion of polydimethylsiloxane and polymonomethylsiloxane on rutile was predicted from water contact angles. Polymonomethylsiloxane was proposed to have the greater adhesion but was small in either case. The stability of dimethyl and monomethyl polysiloxanes pigmented with rutile and zinc oxide was evaluated in a simulated solar ultraviolet environment. Author (GRA)

N73-19566# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
CYCLICALLY INDUCED MECHANICAL HYSTERESIS OF A GLASS FIBER-REINFORCED PLASTIC
Stephen A. Sutton Oct. 1972 30 p refs
(Contract N00019-72-C-0274; Grant NSF GY-7550)
(AD-753823; UILU-ENG-72-6010; T/AM-362) Avail: NTIS CSCL 11/9

Glass fiber-reinforced plastic unidirectional specimens under axial tensile-compressive cyclic loading at an angle of 45 degrees to the fiber direction exhibited measurable hysteresis. The behavior of the hysteresis with cyclic loading is reported and the usefulness of this technique as a non-destructive testing tool is discussed. Author (GRA)

N73-19567# Panametrics, Inc., Waltham, Mass.
MEASUREMENT OF ELASTIC MODULI OF MATERIALS AT ELEVATED TEMPERATURE Quarterly Progress Report, period ending 14 Nov. 1972
E. P. Papadakis, K. A. Fowler, L. C. Lynnworth, E. H. Carnevale, and J. Chen 14 Nov. 1972 61 p refs
(Contract N00014-73-C-0023; NR Proj. 384-320)
(AD-753844) Avail: NTIS CSCL 14/2

Contents: Attenuation compensation for measuring ultrasonic velocity at high temperatures in one or more segments of wire; Versatile ultrasonic facility for operation to 1000C; Measurements on Remendur to 1000C; Statistical errors in attenuation and reflection coefficient; Momentary contact experiments for moduli and attenuation at elevated temperatures; Polymerization of plastics; Nomogram for attenuation and reflection coefficient; Ultrasonic velocity in sheet material. GRA

N73-19568# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
AN INVESTIGATION OF THE MECHANICAL PROPERTIES OF SILICON CARBIDE AND SAPPHIRE FILAMENTS Technical Report, Jan. - Aug. 1972
R. L. Crane Sep. 1972 38 p refs
(AF Proj. 7351)
(AD-753711; AFML-TR-72-180) Avail: NTIS CSCL 11/5

The mechanical properties of SiC and Al2O3 (sapphire) filaments pertinent to the initial design of a metal matrix composite was documented. The strength contributions of these filaments to a composite were simulated with tensile tests of self-abraded samples. The strength of virgin SiC filament was found to decrease linearly to about 1100C (2012F) and exponentially above this temperature. The abraded strength was found to be constant, as a function of temperature, to about 1100C (2012F). The loss of high temperature strength was correlated with the reaction between SiC and the fiber's W core. The strength of single crystal sapphire as a function of temperature was determined for both a- and c-axis filaments. Similar tests were conducted on ruby fiber (Cr2O3 doped sapphire). Author (GRA)

N73-19569# Hercules, Inc., Cumberland, Md. Ballistics Lab.
DESIGN, MANUFACTURE AND DELIVERY OF SMALL ROCKET MOTORS Final Technical Report, 15 Feb. - 15 Oct. 1972
E. A. Stair Nov. 1972 70 p refs
(Contract DAAH01-72-C-0576)
(AD-753959) Avail: NTIS CSCL 11/4

The report describes the design, manufacture and delivery of 90 small-diameter (3 inch) inert rocket motors and for the manufacture and delivery of 60 bond-joint test specimens. Thirty fiberglass composite chambers (S-904 glass roving) and thirty graphite composite chambers (AS graphite filament) were

manufactured. The chambers were lined with silica-filled styrene butadiene rubber (SBR) insulation and cast with inert, simulated hydroxy-terminated polubutadiene (HTPB) propellant. The inert propellant comprised HTPB binder, isocyanate crosslinker, inert salt (NaCl), and aluminum powder. Thirty maraging steel chambers were received from the U.S. Army Missile Command, and these chambers were also lined with silica filled SBR insulation and cast with inert HTPB propellant. Author (GRA)

N73-19570# Case Western Reserve Univ., Cleveland, Ohio.
INTERFACE AND MECHANICS RESEARCH IN FIBER REINFORCED COMPOSITES Final Report, 17 May 1970 - 16 May 1971
Harry R. Nara Mar. 1972 280 p refs
(Contract F33615-70-C-1016; ARPA Order 719)
(AD-754249; AFML-TR-71-260) Avail: NTIS CSCL 11/4

Experimental and analytical investigations were performed to provide increased understanding of the fundamental behavior of fiber reinforced plastic composites. The research was conducted in a number of discrete tasks which were grouped into three principal categories, namely: materials research, mechanics of composites, and analysis and design of composite structures. Author (GRA)

N73-19571# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
RATE AND TIME DEPENDENT YIELD BEHAVIOR OF A DUCTILE POLYMER
H. F. Brinson Nov. 1972 37 p refs Presented at the Battelle Colloq. on Deformation and Fracture of High Polymers, Kronberg, Germany, 11-16 Sep. 1972
(Contract DAAF07-69-C-0444)
(AD-753941; VPI-E-72-23) Avail: NTIS CSCL 11/9

A brief discussion is presented of the use of polymers in general and polycarbonate in particular in experimental mechanics both from the viewpoint of materials for use in photomechanics and as materials for use in the validation of continuum constitutive equations. Experimental data is presented showing polycarbonate to be a ductile material with elastic, viscoelastic and plastic behavior regimes. Using constant head rate tests (0.002 in./min. to 20 in./min.), the rate dependent yield behavior of polycarbonate is presented and compared to behavior proposed for metals by Ludwik. Also, using creep tests, the time dependent yield behavior of polycarbonate is presented and compared to viscoelastic-plastic theories of Nagdi and Murch, and Crochet. Finally, possible application of the results to photoplasticity and ductile fracture are discussed. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-19572*# Scientific Translation Service, Santa Barbara, Calif.
MATHEMATICAL METHODS FOR MODELING IN SPACE RESEARCH
Yu. K. Khodarev, ed. et al Washington NASA Mar. 1973 368 p refs Transl. into ENGLISH of the book "Mat. Metody Modelirovaniya v Kosmich. Issled." Moscow, Nauka Press, 1971
(Contract NASw-2035)
(NASA-TT-F-731) Avail: NTIS HC $6.00 CSCL 12A

Mathematical models and numerical methods for adaptive spacecraft control problems and mapping of celestial bodies are reported. For individual titles, see N73-19573 through N73-19587.

N73-19573* Scientific Translation Service, Santa Barbara, Calif.
A METHOD OF USING A DIGITAL COMPUTER FOR CONTROLLING INSTRUMENTS ABOARD SPACECRAFT c08
L. N. Lupichev, Yu. K. Khodarev, and I. V. Shamanov *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 1-24 refs (For availability see N73-19572 10-19)
CSCL 09B

The problem of using digital computers to control onboard spacecraft instruments is considered by developing a method for simulating the functions of the logical unit of the control system and by formulating a program for the control computer. A block diagram depicts connection of the control system in the onboard computer. The advantages and disadvantages of such a system are discussed. Author

N73-19574* Scientific Translation Service, Santa Barbara, Calif.
A PROGRAM FOR REALIZING THE FUNCTIONS OF THE PROGRAM-SEQUENCING DEVICE ON AN ON-BOARD DIGITAL COMPUTER USED IN THE CONTROL SYSTEM GOVERNING THE EQUIPMENT ABOARD SPACECRAFT c08
I. V. Shamanov *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 25-42 ref (For availability see N73-19572 10-19)
CSCL 09B

A system controlling the onboard spacecraft instruments by an onboard digital computer operating in real time in order to perform the functions of the program sequencer is studied. A method for simulating the functions of the program sequencer on the onboard digital computer is used to develop a program for the onboard digital computer performing the functions of the program sequencer. Author

N73-19575* Scientific Translation Service, Santa Barbara, Calif.
A PROBABILISTIC MODEL OF CONTROL DIGITAL COMPUTERS FOR THE PURPOSE OF ESTIMATING THE EFFECTIVENESS OF THE COMMUNICATION BETWEEN A DIGITAL COMPUTER AND INFORMATION SOURCES AND RECEIVERS c08
Ye. I. Ruchka *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 43-72 refs (For availability see N73-19572 10-19)
CSCL 09B

A computational system being part of a digital computer, input and output devices, and subscribers are considered as a mass-servicing system. An investigation of the system operation leads to recommendations for improving the way in which a digital computer is supplemented with external devices. Author

N73-19576* Scientific Translation Service, Santa Barbara, Calif.
AN ANALYSIS OF A CONTROL DIGITAL COMPUTING COMPLEX AS A MULTISTAGE SYSTEM OF MASS SERVICING c08
Ye. I. Ruchka *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 73-88 refs (For availability see N73-19572 10-19)
CSCL 09B

A formal description is given of a control digital computing complex as a multiphase mass system servicing two classes of demands: the demands generated by one of the units of the mass servicing system and the demands from an external source. A method for analyzing a number of characteristics of a control digital complex is described and its use on examples of mass servicing systems is outlined, reflecting some features of its operation for various queueing disciplines. Author

N73-19577* Scientific Translation Service, Santa Barbara, Calif.
THE POSSIBILITY OF A UNIQUE DETERMINATION OF THE ELECTRON CONCENTRATION FROM THE RESULTS OF PHASE MEASUREMENTS c24
V. L. Azarov, V. I. Novozhilov, and G. A. Tavrizov *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 89-98 refs (For availability see N73-19572 10-19)
CSCL 20H

The possibility of determining the local concentration of electrons in the solar corona from results of a phase experiment taking place for a limited period of time is considered. The corona is assumed to be spherically symmetric. The uniqueness of the determination of concentration is proved by reducing the problem to an inverse potential problem. Author

N73-19578* Scientific Translation Service, Santa Barbara, Calif.
THE INFLUENCE OF THE DAY-NIGHT EFFECT IN THE DISTRIBUTION OF THE ATMOSPHERIC DENSITY ON THE DECELERATION OF THE ARTIFICIAL EARTH SATELLITES c13

P. Ye. Elyasberg and B. V. Kugayenko *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 99-142 refs (For availability see N73-19572 10-19)
CSCL 04A

The influence of the day-night effect in the distribution of the atmospheric density and on the variation of the period of revolution and eccentricity of an artificial earth satellite is discussed. Closed approximate formulas expressing those variations are obtained. It is shown that when determining the parameters of the upper atmosphere from the deceleration of satellites by means of formulas obtained without considering the day-night effect, significant errors can be introduced. Estimates for these errors are presented. Author

N73-19579* Scientific Translation Service, Santa Barbara, Calif.
LONG-TERM PREDICTION OF THE MOTION OF ARTIFICIAL EARTH SATELLITES IN NEARLY-CIRCULAR ORBITS TAKING ACCOUNT OF AN ARBITRARY NUMBER OF ZONAL HARMONICS c31
B. V. Kugayenko and P. Ye. Elyasberg *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 143-161 refs (For availability see N73-19572 10-19)
CSCL 22A

A system of analytic relations is derived for determining the long term variations of the elements of nearly circular orbits of artificial earth satellites. These relations yield the values of the elements at an orbit's ascending nodes as a function of the revolution number. Thereby the effect of an arbitrary number of zonal harmonics in the expansion of the earth's gravitational potential can be taken into account, along with the effect of the gravitational perturbations from the Moon and the Sun and the effect of atmospheric drag. It is shown that the effect of all higher zonal harmonics can be taken into account with the help of six matching parameters. Author

N73-19580* Scientific Translation Service, Santa Barbara, Calif.
AERODYNAMIC COMPENSATION FOR THE PERTURBING MOMENTS ACTING ON A SPACECRAFT c31
B. E. Kashonov *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 162-199 refs (For availability see N73-19572 10-19)
CSCL 22B

Perturbations acting on orientation and stabilization of an artificial earth satellite are discussed. The problem of applying aerodynamic compensators for the aerodynamic and gravitational perturbing moments is elucidated. Relations are deduced for selecting the parameters of the compensators and for analyzing the feasibility of mounting them on a model of an artificial earth satellite moving along a circular orbit and stabilized with respect to the velocity vector by means of reaction motors. The sequence of the analysis is indicated for certain types of aerodynamic compensators. Author

N73-19581* Scientific Translation Service, Santa Barbara, Calif.
CONTROL SYSTEMS WITH DISCONTINUOUS LINKS AND WAYS OF OPTIMIZING THEIR CONTROL c31
L. I. Shatrovskiy *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 200-220 refs (For availability see N73-19572 10-19)
CSCL 22B

The problem of optimum control with links which undergo discontinuities of the first kind at a finite number of trajectory points is considered. A method of improving the control functions in order to solve the problem of optimal control with continuous links is further improved, so that it may be used also to solve problems with discontinuous links. The use of the method is illustrated with the problem of optimizing control of a spacecraft with stages. It is shown that the method developed may be applied to solving multifrequency boundary value problems of optimum control. Author

N73-19582* Scientific Translation Service, Santa Barbara, Calif.
CERTAIN NUMERICAL TECHNIQUES OF SOLVING VARIATIONAL PROBLEMS OF FLIGHT DYNAMICS c30
Z. N. Mamotko, A. Z. Otpushchenko, and L. I. Shatrovskiy *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 221-253 refs (For availability see N73-19572 10-19)
CSCL 22C

Several methods for solving variational problems by improving the control functions are presented. These methods include replacing the initial problem by a reciprocal one: forming connections which change the boundaries of the region for selecting the phase coordinates of a system into boundaries of a region for selecting the control functions. The methods also include dividing the variational problem into subproblems, and also the method of the sliding interval. The use of some of these methods is illustrated with the problem of deriving the payload on a circular orbit of maximum altitude. Author

N73-19583* Scientific Translation Service, Santa Barbara, Calif.
FORMULATING A MATHEMATICAL MODEL OF CONTROLLED MOTION OF A SPACECRAFT UNDER UNDETERMINED CONDITIONS c31
Z. N. Mamotko and L. I. Shatrovskiy *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 254-273 refs (For availability see N73-19572 10-19)
CSCL 22B

A model for synthesizing the control of a spacecraft flight is constructed by improving the control functions. The model of controlled flight is based on three particular models: the model of the spacecraft motion, the model of obtaining information about the flight, and the model of the control system. The introduction into each of the models of errors and perturbing factors, such as random quantities and random functions, is modeled. The model is constructed in order to compare equipment in the design stages under conditions which as closely as possible simulate the conditions of their future use. Author

N73-19584* Scientific Translation Service, Santa Barbara, Calif.
GRADIENT METHODS FOR ESTIMATING PARAMETERS IN A MATHEMATICAL TREATMENT OF MEASUREMENTS
V. A. Krasikov and A. P. Tishchenko *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 274-287 refs (For availability see N73-19572 10-19)
CSCL 12A

The basic computational difficulty in photogrammetric processing of planetary photographs obtained from spacecraft, of compiling systems of space triangulation and other similar problems is the necessity of compiling and solving incompatible systems of linear equations of a higher order under given conditions. For solving such systems, gradient methods are proposed. Such an approach makes it possible to effectively employ the computer memory. Author

N73-19585* Scientific Translation Service, Santa Barbara, Calif.
EFFICIENCY OF THE METHODS OF NUMERICAL INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS
V. G. Pankratyev *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 288-318 refs (For availability see N73-19572 10-19)
CSCL 12A

A classification of numerical integration methods is reported. On the basis of a mathematical experiment an estimate of some properties of methods of various types is given. Organization and particular results of a mathematical experiment involving a selection of free parameters for those methods are described. The question of increasing the efficiency and integration with an automatic selection of the step size is also discussed. Author

N73-19586* Scientific Translation Service, Santa Barbara, Calif.
NUMERICAL INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS IN REAL TIME SIMULATION
V. G. Pankratyev *In its* Math. Methods of Modeling in Space Res. Mar. 1973 319-356 refs (For availability see N73-19572 10-19)
CSCL 12A

A survey of the basic papers in the area of numerical integration of ordinary differential equations is reported. The questions of accuracy, stability, and efficiency of numerical integration, the selection of the method and integration step size in real-time simulation are discussed. Author

N73-19587* Scientific Translation Service, Santa Barbara, Calif.
AN APPROXIMATE CALCULATION OF THE EPHEMERIS OF AN OBJECT FROM THE MEASUREMENTS OF ITS

COORDINATES FROM DIFFERENT POINTS ON THE SURFACE OF THE EARTH
I. V. Isavnina *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 357-363 (For availability see N73-19572 10-19) CSCL 12A

The accuracy of the ephemeris of a celestial object moving in a nonperiodic trajectory may turn out to be insufficient for orienting narrow angle observational instruments. The question of improving the accuracy of ephemeris topocentric coordinates from results of its observations from other points is considered. An estimate is given of the necessary accuracy of such observations and formulas are derived which express a relation between the coordinates measured and the observational points on the surface of the earth. Author

N73-19588*# Linguistic Systems, Inc., Cambridge, Mass.
GENERALIZATION OF SOME INVESTIGATIONS OF A. M. LIAPUNOV ON LINEAR DIFFERENTIAL EQUATIONS WITH PERIODIC COEFFICIENTS
M. G. Kreyn Washington NASA Mar. 1973 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 73, no. 3, 1950 p 445-448
(Contract NASw-2482)
(NASA-TT-F-14835) Avail: NTIS HC $3.00 CSCL 12A

A system of n = 2m differential equations of the form dx/dt = lambdo JH(t)x is studied. Results of recent research done on the solutions of these differential equations, based upon the work of A.M. Liapunov, are described. Author

N73-19589# Technischen Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
EXPANSIONS THROUGH ORTHONORMALIZED EIGENFUNCTIONS AND APPLICATIONS IN POINT MECHANICS [ENTWICKLUNGEN NACH ORTHONORMIERTEN EIGENFUNKTIONEN UND IHRE VERWENDUNG IN DER PUNKTMECHANIK]
Mafred Schneider 28 Sep. 1972 33 p refs In GERMAN; ENGLISH summary
(BMBW-FB-W-72-33) Avail: NTIS HC $3.75, ZLDI Munich: 7 DM

The expansion of various functions by using eigenfuctions originating from boundary value problems is discussed. Several applications to initial value and boundary value problems in orbital mechanics are shown. Author

N73-19590# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
NUMERICAL CALCULUS ELEMENTS, PART 1
P. Salvadori 15 Sep. 1972 82 p In ITALIAN; ENGLISH summary
(ISS-72/13-Pt-1) Avail: NTIS HC $6.25

After some preliminary remarks on the importance of applied mathematics in the solution of scientific problems, the general subject of numerical approximation is discussed. Some methods for the approximate solution of algebraic and transcendental equations are presented along with the most common schemes for the solution of simultaneous linear and nonlinear equations. Interpolation and extrapolation are studied together with the subject of numerical differentiation and integration. Finally, some hints on the solution of differential equations are given. Author

N73-19591# Karlsruhe Univ. (West Germany). Inst. fuer Nachr Ichtenverarbeitung und Nachrichtenuebertragung.
DIGITAL CORRELATION OF TWO-DIMENSIONAL DATA STRUCTURES BASED ON FAST FOURIER TRANSFORMATION [DIGITALE KORRELATION ZWEIDIMENSIONALER DATENSTRUKTUREN AUF DER GRUNDLAGE DER SCHNELLEN FOURIER TRANSFORMATION]
H. Kazmierczak and F. Roecker Bonn Bundeswehramt 1972 83 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-1) Avail: NTIS HC $6.25; Bundeswehramt, Bonn: 25 DM

The application of the two-dimensional Fourier transform and digital correlation for picture processing, the relation between digital and continuous Fourier transform, and a formal representation of two-dimensional signals are examined. A matrix representation of the discrete Fourier transform, a general theory of factorization, and the relations between correlation and filtering of images and their discrete realization are also reviewed. Transformation algorithms and data structures are described, and an estimation of required computer time is given. Auxiliary programs and some applications together with results are discussed. Author (ESRO)

N73-19592# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
MAXIMUM PRINCIPLE FOR SYSTEMS WITH DELAY DEPENDING ON STATE, CONTROL AND TIME
Andrzej Manitius and Stanislaw Fijalkowski (Polytechnical Univ. of Warsaw) 8 Dec. 1972 53 p refs
(Grant AF-AFOSR-2078-71; AF Proj. 9769)
(AD-753675; AFOSR-72-2332TR) Avail: NTIS CSCL 12/1

Optimal control problems for systems described by differential equations with a delayed argument depending on state, control and time are considered. Unlike previous work in this area, there is no restrictive assumption on the monotonicity of the delayed argument with respect to time. The class of admissible controls consists of bounded measurable functions. The terminal point of the trajectory is assumed to be free or constrained by an inequality. Necessary conditions for optimality in the form of a maximum principle are derived via Gabasov's method. The problem of discontinuity of the adjoint variables, as well as other essential features of the maximum principle, are discussed. An example given in the Appendix shows that the optimal behavior of the delay need not necessarily consist in zeroing the delay on the whole time interval. Author (GRA)

N73-19593# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
CONTROLLABILITY, OBSERVABILITY, AND STABILIZABILITY OF DYNAMICAL SYSTEMS IN BANACH SPACE WITH BOUNDED OPERATORS Ph.D. Thesis. Interim Report
Roberto Triggiani Dec. 1972 232 p refs
(Grant AF-AFOSR-2243-72)
(AD-753716; AFOSR-72-2335TR) Avail: NTIS CSCL 12/1

The classical theory of controllability and observability is extended to problems which are infinite dimensional. The question of exact controllability in a Banach space is studied in detail. Approximate state and output controllability is studied for the generalized dynamical systems with bounded operators. Author (GRA)

N73-19594# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
ON AN EQUATION RELATED TO NONLINEAR SATURATION OF CONVECTION PHENOMENA
Ferdinand Cap (Innsbruck Univ., Austria) and Herbert Lashinsky Aug. 1972 26 p refs Presented at the 6th Intern. Conf. on Nonlinear Oscillations, Poznan, Poland, 29 Aug. - 4 Sep. 1972
(Contract AT(40-1)-3405; Grant AF-AFOSR-2179-72; AF Proj. 9783)
(AD-754228; BN-745; AFOSR-73-0015TR) Avail: NTIS CSCL 12/1

A number of problems involving convection-like phenomena give rise to an equation of the form y double prime + (alpha) y prime: - ay = 0 when the problem is treated in the linear approximation. It is proposed that the description of nonlinear saturation of the convection process requires the introduction of a phenomenological cubic term with a positive coefficient to yield an equation of the form y double prime + (alpha) y prime: - ay + b(y)3 = 0 which provides saturation of the dependent variable when y = 1/(a/b). The significance of this term in various physical problems is discussed. In the mathematical analysis of the equation the parameter ranges for oscillatory and non-oscillatory solutions are discussed and related to the pertinent physical problems. Author (GRA)

N73-19962 British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
THE K FACTOR IN AIR-TO-GROUND ACQUISITION MODELLING
D. G. Silverthorn *In* AGARD Air to Ground Target Acquisition Nov. 1972 14 p refs (For availability see N73-19959 10-34)

20 METEOROLOGY

Includes climatology;. weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-19595 Arizona Univ., Tucson.
A THEORETICAL INVESTIGATION OF THE EVOLUTION OF A CLOUD DROPLET POPULATION AS DETERMINED BY COLLISION AND COALESCENCE Ph.D. Thesis
Alexis Boris Long 1972 193 p
Avail: Univ. Microfilms Order No. 72-23350

A partial contribution toward a parametric description of n(x,t) designed to simplify the evaluation of n(x,t) and permit the ready incorporation of collection effects into cloud models is reported. A parametric description of n(x,t) is viewed as a function of x and t containing as time dependent parameters those cloud physical variables describing the overall behavior of n(x,t). The time dependence of the cloud physical variables is obtained from solutions for the closely related statistical moments of n(x,t). Closed expressions for the time dependence of the cloud-physical variables, derived from the moment solutions, confirm present thinking on the overall behavior of a droplet population evolving through collection. Dissert. Abstr.

N73-19596 Florida State Univ., Tallahassee.
A STUDY OF ATMOSPHERIC FLOW OVER A TROPICAL ISLAND Ph.D. Thesis
Russell Lawrence DeSouza 1972 221 p
Avail: Univ. Microfilms Order No. 72-22998

During the Florida State University experiments in the summers of 1968 and 1969, a systematic and intensive effort was exerted to obtain a set of observations of the kinematic and thermodynamic fields that exist over an island. The island of Barbados was considered representative of a heat source and sink in an undisturbed, sheared wind field. The observational data were restricted to days that exhibited cloudiness patterns associated with basically suppressed cloud forms (cumulus humilis and cumulus congestus). This stratification optimized the influence of the surface heating and cooling as a forcing function on an otherwise balanced atmospheric state. The observations used in this study consisted of wind instruments at the eight-meter level; wind measurements from constant density balloon trajectories and from sychronized pilot balloon releases; and infrared, dry-bulb, and dew-point temperatures acquired along aircraft flight tracks. These data were combined and revealed the observational details which are listed. Dissert. Abstr.

N73-19597 Florida State Univ., Tallahassee.
SQUALL LINE STRUCTURE AND MAINTENANCE: NUMERICAL EXPERIMENTATION Ph.D. Thesis
Carl Edward Hane 1972 211 p
Avail: Univ. Microfilms Order No. 72-23002

The environmental conditions known to be favorable for squall line development and maintenance include the following: (1) a convectively unstable air mass in the area, (2) strong vertical shear of the horizontal wind, and (3) some lifting mechanism in the area capable of releasing the instability. These conditions are used as guidance in specifying initial and boundary conditions for a time dependent two-dimensional numerical model designed to simulate the squall line thunderstorm. Time changes in the motion, thermal, and moisture fields within and surrounding the thunderstorm are calculated mainly by explicit treatment of those physical processes believed to be most important in such a system. Other processes are not treated explicity, but are parameterized in terms of known quantities. Quantitative calculations show that the squall line thunderstorm is self-propagating, maintaining itself by means of interaction with its environment as long as it remains within an environment processing favorable thermodynamic and kinematic properties. Dissert. Abstr.

N73-19598 Florida State Univ., Tallahassee.
A STUDY OF THE TROPICAL OCEANIC SUBCLOUD LAYER Ph.D. Thesis
Ward Raymond Seguin 1972 239 p
Avail: Univ. Microfilms Order No. 72-23012

A study of the tropical oceanic subcloud layer has been made using data collected with the USCGS DISCOVERER, the buoy TRITON, a 16-m tower at East Point on Barbados, a rawinsonde system at Seawell, Barbados, and the NCAR Queen Air aircraft during the 1969 Barbados experiment. Emphasis has been placed upon determining the thermodynamic structure of the subcloud layer for a range of atmospheric conditions from undisturbed to disturbed states. Differences in the observed structure have been related to the scales of motion which dominate in the differing atmospheric states. The vertical fluxes of sensible and latent heat through the air-sea interface have been examined as a function of recognized scales of motion (such as synoptic- and meso-scale) and associated processes in the subcloud and cloud layer. The data have been subjected to time and space series analysis including bandpass filtering and variance analysis. The results and conclusions are summarized. Dissert. Abstr.

N73-19599 Texas A&M Univ., College Station.
ATMOSPHERIC ENERGETICS AS RELATED TO CYCLOGENESIS OVER THE EASTERN UNITED STATES Ph.D. Thesis
Philip Walter West 1972 119 p
Avail: Univ. Microfilms Order No. 72-24341

A method is presented to investigate the atmospheric energy budget as related to cyclogenesis. Energy budget equations are developed that are shown to be advantageous because the individual terms represent basic physical processes which produce changes in atmospheric energy, and the equations provide a means to study the interaction of the cyclone with the larger scales of motion. Two examples of cyclogenesis over the eastern United States were chosen for study. One of the cases (1-4 November 1966) represented an example of vigorous development, while the development in the other case (5-8 December 1969) was more modest. Objectively analyzed data were used in the evaluation of the energy budget terms in order to minimize computational errors, and an objective analysis scheme is described that insures that all of the resolution contained in the rawinsondé observations is incorporated in the analyses. Dissert. Abstr.

N73-19600 International Geophysical Year World Data Center A, Asheville, N.C.
METEOROLOGY DATA REPORT: HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 8, NO. 4, APRIL 1971
1972 246 p
Avail: Dept. of Commerce, NOAA. Natl. Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N73-19601 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 122, NO. 12: AEROLOGICAL DATA, BERLIN-TEMPELHOF, DECEMBER 1971 [METEOROLOGISCHE ABHANDLUNGEN. BAND 122, HEFT 12: AEROLOGISCHE DATEN, BERLIN-TEMPELHOF, DEZEMBER 1971]
1971 142 p refs In GERMAN; ENGLISH summary
Avail: Issuing Activity

The detailed results of radiosonde ascents performed by the aerological station of the meteorological Institute of the Free University of Berlin are presented. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The temperature curve of the climatological mean and the data of the ozone-ascents are given in tabular and graphical form. Author

N73-19602 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 128, NO. 8: RESULTS OF THE SYNOPTIC SERVICE DURING 1972. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb, 850 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, AUGUST [METEOROLOGISCHE ABHANDLUNGEN. BAND 128, HEFT 8: ERGEBNISSE DES SYNOPTISCHEN DIENSTES

IM JAHRE 1972. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 mb, 850 mb), TABELLEN UND KLINERE WISSENSCHAFTLICHE AUFSAETZE, AUGUST]
1972 199 p refs In GERMAN
Avail: Issuing Activity

Daily and mean monthly climatological weather maps and data tables obtained in Berlin are presented for August, 1972. Included brief scientific reports cover: Weather forecasting for Central Europe and Munich Olympics, daily temperature data for Berlin, and medical aspects of meteorology. Transl. by G.G.

N73-19603 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 128, NO. 9: RESULTS OF THE SYNOPTIC SERVICE DURING 1972. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb, 850 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, SEPTEMBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 128, HEFT 9: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1972. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 mb, 850 mb), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, SEPTEMBER]
1972 197 p In GERMAN
Avail: Issuing Activity

Daily and mean monthly climatological weather maps and data tables obtained in Berlin readings are presented for September, 1972. Included brief scientific reports cover: Smoke cloud identification in satellite pictures, remote surveillance of earth surface by satellite, and lowest 5 cm height temperature measurements at Berlin from 1952 through 1972.
Transl. by G.G.

N73-19604 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 123, NO. 4: DAILY ALTITUDE MAPS OF THE 50 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1971, PART 4 [METEOROLOGISCHE ABHANDLUNGEN. BAND 123, HEFT 4: TAEGLICHE HOEHENKARTEN DER 50 mb-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1971]
1971 116 p In GERMAN; ENGLISH summary
(QR-4-Pt-4) Avail: Issuing Activity

The present volume continues the series of stratospheric weather maps published since 1957 in the meteorological data of the Meteorological Institute of the Free University. It contains daily height and temperature analysis of constant pressure levels for three months for the whole of the Northern Hemisphere, based on rawinsonde and in the upper stratosphere also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps are included with their variations and deviations as well as the mean gridpoint data, calculated from daily values. Moreover, the stratospheric circulation of polar, middle, and tropical latitudes is described for the period under consideration. Author

N73-19605 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 133, NO. 2: THE EUROPEAN CLIMATOLOGY 1972. WEATHER SATELLITE OBSERVATIONS AT THE BERLIN APT STATION, PART 2 [METEOROLOGISCHE ABHANDLUNGEN. BAND 133, HEFT 2: DAS EUROPAEISCHE WETTERBILD 1972. WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH]
1972 189 p In GERMAN
(QR-2) Avail: Issuing Activity

European climatological maps for the second quarter in 1972 are obtained from ESSA 8 photographs. All cloud mosaics include a geographical coordination net constructed from central picture points, respectively, sub-satellite points and median satellite orbital heights. Transl. by G.G.

N73-19606 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 129, NO. 1: DAILY GROUND MAPS OF THE NORTHERN HEMISPHERE FOR 1972, PART 1 Semiannual Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 129, HEFT 1: TAEGLICHE BODENKARTEN DER NORDHEMISPHAERE IM JAHRE 1972. TEIL I, 1. HALBJAHX]
1972 185 p In GERMAN
(SAR-1-Pt-1) Avail: Issuing Activity

Daily meteorological maps of the Northern Hemisphere presented contain atmospheric ground level observations for January through June, 1971. Transl. by G.G.

N73-19607 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 121, NO. 2: DAILY GROUND MAPS OF THE NORTHERN HEMISPHERE FOR 1971, PART 2 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN: BAND 121, HEFT 2: TAEGLICHE BODENKARTEN DER NORDHEMISPHAERE IM JAHRE 1971. TEIL II, 2. VIERTELJAHR]
1971 94 p In GERMAN
(QR-2-Pt-2) Avail: Issuing Activity

Daily meteorological maps of the Northern Hemisphere presented contain atmospheric ground level observations for the second quarter in 1971. Transl. by G.G.

N73-19608# Schweizerische Meteorologische Zentralanstalt, Zurich.
THE THUNDERSTORM CONDITIONS IN THE SOUTHERN CENTRAL ALPS AND BEGINNING ALPS (CONTINUATION OF NO. 22). 2. THE INDIVIDUAL THUNDERSTORMS AND THEIR DISTRIBUTION. 3. THE DURATION OF THUNDERSTORMS [DIE GEWITTERVERHAELTNISSE IN DEN SUEDLICHEN ZENTRALALPEN UND VORALPEN (FORTSETZUNG VON NR. 22). 2: DIE EINZELNEN GEWITTER UND IHRE VERTEILUNG. 3: DIE DAUER DER GEWITTER]
E. Zenone 1972 31 p refs In GERMAN; ENGLISH summary
Avail: NTIS HC $3.75

Different types of thunderstorms occurring on days with perturbations are analyzed. Probably because of the shortness of the observational series the distribution is very broad, especially in the case of thunderstorms with southerly upper air current (Sudstau). The distribution clearly proves the maximum frequency in the region of the Centovalli and the Gridone, then a rapid decrease from there to Cevio and a much slower decrease from Cevio to Bedretto. A further maximum of local thunderstorms is presented in the region of Bedretto. Days with the highest number of thunderstorms belong to the Sudstau type, whereas local thunderstorms show the lowest frequencies. The latter have a higher percentage of frequency for all cases with only one thunderstorm per day with perturbation. The cases of Sudstau, on the other hand, show the lowest frequencies of all three types of thunderstorms. Author

N73-19609# Schweizerische Meteorologische Zentralanstalt, Glattbrugg.
ANALYSIS OF RAININESS IN CENTRAL VALAIS [ANALYSE DE LA PLUVIOSITE DANS LE VALAIS CENTRAL]
J. Catzeflis, B. Primault, and H. Strehler 1972 17 p refs In FRENCH; ENGLISH summary
(Rept-28) Avail: NTIS HC $3.00

Precipitations in a dry climate, as we find it in Valais, are very important for all human activities, but especially for farmers. The frequency of rainfalls below a certain limit indicates the necessity of irrigation. Irrigations bring each time a multiple of potential daily evapotranspiration. A weekly synopsis of the precipitations was carried out first, but the exact computation, however, was reached by 5 days. At that time it was also discovered that strong or frequent irrigations had the contrary effect during certain periods (especially in August). The distribution of the precipitations during a day's time had also an effect on the farmwork. During an hourly evaluation it was noticed that it rained less in daytime than in night-time, but that the minimum risk varied according to a well defined seasonal curve. Additionally, an attempt was made to define the risk of rainfall in the morning, respectively in the afternoon in case that it was raining at 07.00 or at 13.00 h (times of departure to the fields). Author

N73-19610# Schweizerische Meteorologische Zentralanstalt, Zurich.
FOEHN OF VALAIS [LE FOEHN DU VALAIS]

Max Boueet 1972 15 p refs In FRENCH; ENGLISH summary
Avail: NTIS HC $3.00

Wind measurements were recorded in Chippis near Sierre (canton Valais/Switzerland) from 1954 to 1970 without interruption. This 17 year period of data provides a complete documentation about foehn in the central part of the valley of the Rhone in the canton Valais. Mean and extreme values of frequency, duration and velocity of the warm winds were considered. The strong daily variation of frequency, with maxima between 3 and 6 o'clock p.m. The most frequent wind direction in the altitude is the one from SW to SSW. The foehn in the other valleys of the canton Valais is less known and, therefore, treated in a summary way. The so-called 'Lombarde' or east wind of the southern side of the Bernese Alps as well as the foehn wall are both complementary aspects of foehn, completing the picture of this typical wind, which is less frequent in the Valais than in Central Switzerland, but has the same characteristics in both regions. Author

N73-19611# National Environmental Satellite Service, Washington, D.C.
A TECHNIQUE FOR THE ANALYSIS AND FORECASTING OF TROPICAL CYCLONE INTENSITIES FROM SATELLITE PICTURES
Vernon F. Dvorak Feb. 1973 22 p refs Supersedes NOAA-TM-NESS-36
(NOAA-TM-NESS-45; NOAA-TM-NESS-36) Avail: NTIS HC $3.25

A technique for using satellite pictures to analyze tropical cyclones is described in detail. Specific instructions are given for detecting changes in cyclone intensity, for estimating the magnitude of the intensity, and for forecasting 24-hour intensity changes. A code for transmitting this information is also described. Author

N73-19612# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, MAY 1972
May 1972 311 p
Avail: NTIS HC $17.75

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. D.L.G.

N73-19613# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN: ATMOSPHERIC OZONE, ATMOSPHERIC ELECTRICITY, LONG WAVE RADIATION, DEW-POINT TEMPERATURE, 1969, 1970
1972 260 p refs
Avail: NTIS HC $15.00

Upper air data obtained by specially designed radiosondes are presented for Japan and its vicinity. The successful observations reported include 237 ozone, 216 atmospheric electricity, 130 radiation, and 10 dew point temperature soundings. D.L.G.

N73-19614# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, JUNE 1972
Jun. 1972 327 p refs
Avail: NTIS HC $18.50

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity wind, pilot-balloon data, and rocketsonde data. Author

N73-19615# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, APRIL 1972
Apr. 1972 303 p refs
Avail: NTIS HC $17.25

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. D.L.G.

N73-19616*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DEVELOPMENT OF HURRICANE INEZ, 1966, AS SHOWN BY SATELLITE NIGHTTIME RADIOMETRIC AND DAYTIME TELEVISION COVERAGE
Lewis J. Allison May 1972 77 p refs
(NASA-TM-X-65943; X-651-72-178) Avail: NTIS HC $6.00 CSCL 04B

A complete documentation of Numbus 2 High Resolution infrared Radiometer data and ESSA-1 and 3 television photographs is presented for the life-time of Hurricane Inez, 1966. Ten computer produced radiation charts were analyzed in order to delineate the three dimensional cloud structure during the formative, mature and dissipating stages of this tropical cyclone. Time sections were drawn throughout the storm's life cycle to relate the warm core development and upper level outflow of the storm with their respective cloud canopies, as shown by the radiation data. Aerial reconnaissance weather reports, radar photographs and conventional weather analyses were used to complement the satellite data. A computer program was utilized to accept Nimbus 2 HRIR equivalent blackbody temperatures within historical maximum and minimum sea surface temperature limits over the tropical Atlantic Ocean. Author

N73-19617# Sandia Labs., Albuquerque, N.Mex.
DISCUSSION OF THE TORNADO ENVIRONMENT AND OCCURRENCE CLIMATOLOGY
R. E. Berry and J. W. Reed Nov. 1972 22 p refs Sponsored by AEC
(SC-M-72-0688) Avail: NTIS

Tornadoes have defied complete description in terms of engineering criteria. The opinions are summarized of many authorities and are presented as a potential base line for an engineering analysis of structures within the tornado environment. Also included is a treatment of the occurrence frequency, damage probability factor, and fatality potential. Author

N73-19618# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION BY SULFUR OXIDES AND SMOKE DURING THE PERIOD OF 1 APRIL 1969 - 31 MARCH 1970 [LA POLLUTION ATMOSPHERIQUE PAR LES OXYDES DE SOUFRE ET LA FUMEE EN BELGIQUE AU COURS DE LA PERIODE DU 1ER AVRIL 1969 AU 31 MARS 1970]
A. Derouane, J. Grandjean, M. Legrand, and G. Verduyn 1972 74 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hygiene et d'Epidemiologie
(Publ-Ser-A-78) Avail: NTIS HC $5.75

Sulfur oxide and smoke concentration data recorded at various Belgian stations in order to determine the amount of atmospheric pollution are given for the period 1 April 1969 to 31 March 1970. ESRO

N73-19619# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 3: AREA 7, NOBEOKA; AREA 8, YAKU SHIMA; AREA 9, AMAMI O SHIMA
May 1972 484 p
(AD-753468) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from Tape Data Family 11 (TDF-11) Marine Surface Observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of Coastal Marine Summaries. Author (GRA)

N73-19620# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF A METHOD OF VARIABLE DIRECTIONS IN PROBLEMS OF NUMERICAL WEATHER FORECASTING
I. G. Sitnikov 13 Oct. 1972 24 p refs Transl. into ENGLISH from Tr. Chislennye Metody Analize i Prognoza Meteorol. Elementov (USSR), no. 17, 1970 p 84-97
(AD-752336; FTD-MT-24-1014-72) Avail: NTIS CSCL 04/2

The paper is a brief exposition of one of the most rapidly converging approximate methods for solving elliptical and parabolic differential equations (variable directions method) and a description of numerical experiments for application of this method in prognostic problems. Test problems are given for solution of the

Poisson equation with a special right hand side; this made it possible to draw preliminary conclusions concerning the relative effectiveness of the method for different values of the parameters of convergence in stationary and nonstationary computation processes. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-19621*# Martin Marietta Corp., Denver, Colo.
AUTOMATED DESIGN AND OPTIMIZATION OF FLEXIBLE BOOSTER AUTOPILOTS VIA LINEAR PROGRAMMING, VOLUME 1 Final Report
Francis D. Hauser Dec. 1972 136 p refs
(Contract NAS8-28482)
(NASA-CR-124124; MCR-72-282-Vol-1) Avail: NTIS HC $9.00 CSCL 17G

A nonlinear programming technique was developed for the automated design and optimization of autopilots for large flexible launch vehicles. This technique, which resulted in the COEBRA program, uses the iterative application of linear programming. The method deals directly with the three main requirements of booster autopilot design: to provide (1) good response to guidance commands; (2) response to external disturbances (e.g. wind) to minimize structural bending moment loads and trajectory dispersions; and (3) stability with specified tolerances on the vehicle and flight control system parameters. The method is applicable to very high order systems (30th and greater per flight condition). Examples are provided that demonstrate the successful application of the employed algorithm to the design of autopilots for both single and multiple flight conditions.
Author

N73-19622*# Martin Marietta Corp., Denver, Colo.
AUTOMATED DESIGN AND OPTIMIZATION OF FLEXIBLE BOOSTER AUTOPILOTS VIA LINEAR PROGRAMMING. VOLUME 2: USER'S MANUAL
Francis D. Hauser, Glen D. Szollosi, and W. Stevens Lakin Dec. 1972 171 p refs
(Contract NAS8-28482)
(NASA-CR-124125; MCR-72-282-Vol-2) Avail: NTIS HC $10.75 CSCL 17G

COEBRA, the Computerized Optimization of Elastic Booster Autopilots, is an autopilot design program. The bulk of the design criteria is presented in the form of minimum allowed gain/phase stability margins. COEBRA has two optimization phases: (1) a phase to maximize stability margins; and (2) a phase to optimize structural bending moment load relief capability in the presence of minimum requirements on gain/phase stability margins.
Author

N73-19623# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
REPORT ON THE DGLR-SYMPOSIUM ON AIR TRAFFIC OPERATION
H. G. Nuesser Dec. 1972 66 p In GERMAN; ENGLISH summary Symp. held at Cologne, 15 Sep. 1972
(DLR-Mitt-72-24) Avail: NTIS HC $5.50; ZLDI Munich: 14,30 DM

The proceedings of a symposium on flight operations and air traffic control are presented. The present situation and problems affecting airports, general aviation, air traffic controllers, and governmental agencies for air navigation are discussed. Actions being taken by various segments of the air transportation organization are included. For individual titles, see N73-19624 through N73-19629.

N73-19624 Arbeitsgemeinschaft Deutscher Verkehrsflughaefen, Stuttgart (West Germany).
THE TRAFFIC LANDING FIELDS TODAY [DIE VERKEHRSLANDEPLAETZE HEUTE] **c11**
Kurt Siebenwurst *In* DGLR Report on the DGLR-Symp. on Air Traffic Operation Dec. 1972 p 7-14 In GERMAN (For availability see N73-19623 10-21)

The characteristics and functions of various types of aircraft landing fields are discussed. The organization for the construction, control, and operation of airfields is described. A statistical analysis of the growth of air traffic in Germany is developed to show the basic cause for many of the air traffic problems. Plans for the development of airports and the expected benefits to flight safety are included.
Transl. by P.N.F.

N73-19625 Arbeitsgemeinschaft Deutscher Verkehrsflughaefen, Stuttgart (West Germany).
AIRPORTS TODAY: SIGNIFICANCE AND PROBLEMS OF AIRPORTS IN TODAYS AIR TRAFFIC [FLUGHAEFEN HEUTE BEDEUTUNG UND PROBLEME DER FLUGHAEFEN IM HEUTIGEN LUFTVERKEHR] **c11**
Udo Wolffram *In* DGLR Report on the DGLR-Symp. on Air Traffic Operation Dec. 1972 p 15-24 In GERMAN (For availability see N73-19623 10-21)

A summary of airports constructed in various European countries and England which comprise a commercial air traffic net is presented. The functions performed by commercial airports are described. The effects of airport operations on the environment are analyzed. The preliminary planning of airports to insure their ability to accomodate the transportation demands is discussed. Methods for improving flight operations and the application of new technologies to airport development are examined.
Transl. by P.N.F.

N73-19626 Deutscher Aeroclub e.V., Frankfurt am Main (West Germany).
FLIGHT OPERATIONS FROM THE VIEWPOINT OF GENERAL AVIATION [FLUGBETRIEB AUS DER SICHT DER ALLGEMEINEN LUFTFAHRT]
Wolfgang Trinkaus *In* DGLR Report on the DGLR-Symp. on Air Traffic Operation Dec. 1972 p 25-31 In GERMAN (For availability see N73-19623 10-21)

The problems of traffic control of general aviation aircraft in Germany are discussed. A statistical analysis of general aviation flying in Germany to include the number of licensed pilots, the number and types of aircraft, and the extent of flying activity is presented. The present methods for controlling general aviation aircraft to avoid aircraft accidents are explained. The control of general aviation aircraft in the United States is reported to show possible applications to the control of German aircraft activities.
Transl. by P.N.F.

N73-19627 Deutsche Lufthansa Aktiengesellschaft, Frankfurt am Main (West Germany).
FLIGHT OPERATIONS FROM THE VIEWPOINT OF COMMERCIAL AIRLINES [FLUGBETRIEB AUS DER SICHT EINER LUFTVERKEHRSGESELLSCHAFT]
Rolf Bebber *In* DGLR Report on the DGLR-Symp. on Air Traffic Operation Dec. 1972 p 33-48 In GERMAN (For availability see N73-19623 10-21)

A statistical analysis of the growth of commercial airlines in Germany during the past 20 years is presented. The problems in air traffic control which have resulted from this expansion are described. The functions of an operations control center to provide safer flying conditions and more efficient operation are explained. The efforts of German airlines to meet the four basic requirements of: (1) safety, (2) passenger comfort, (3) schedule adherence, and (4) economy are reported. The anticipated extent and nature of civil aviation activities in Europe in the near future are included.
Transl. by P.N.F.

N73-19628 Verband Deutscher Flugleiter e.V., Frankfurt am Main (West Germany).
FLIGHT SAFETY PROBLEMS FROM THE VIEWPOINT OF THE AIR TRAFFIC CONTROLLER [FLUGSICHERUNGSPROBLEME AUS DER SICHT DER FLUGLOTSEN] **c02**
Wolfgang Kassebohm *In* DGLR Report on the DGLR-Symp. on Air Traffic Operation Dec. 1972 p 49-54 In GERMAN (For availability see N73-19623 10-21)

The requirements for air traffic control procedures in German airspace which arise from the operation of commercial, military, and general aviation aircraft are described. A statistical analysis of the overall increase in air traffic over Germany from foreign

and domestic operations is presented. A reformed system for air traffic procedures is developed. The continued importance of the air traffic controller for the safe operations of the system is emphasized. Transl. by P.N.F.

N73-19629 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany).
ERROR SOURCES IN TURBULENT PRESSURE FLUCTUATION MEASUREMENTS WITH FLOW AROUND MICROPHONES [FEHLERQUELLEN BEI DER MESSUNG TURBULENTER DRUCKSCHWANKUNGEN MIT UMSTROEMTEN MIKROFONEN] **c12**
H. Fuchs *In* DGLR Report on the 3d Meeting of the DGLR-Sci. Comm. on Flow Mech. Test Tech. Oct. 1972 p 93-103 refs In GERMAN (For availability see N73-19623 10-21)

Nonstationary pressure measurements in turbulent flows by microphones are subject to resolution errors, echo noise, acoustic sensitivity changes, vibration sensitivity, flow circulation noise, and banking-up of vertical and horizontal velocities. Transl. by G.G.

N73-19630*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STAR TRACKING RETICLES AND PROCESS FOR THE PRODUCTION THEREOF Patent Application
Wade O. Smith and Albert R. Toft, inventor (to NASA) Filed 17 Apr. 1972 25 p
(NASA-Case-GSC-11188-2; US-Patent-Appl-SN-244440) Avail: NTIS HC $3.25 CSCL 17G

A method is described for the production of reticles for use in outer space. The product is a quartz base coated with highly adherent layers of chromium, chromium-silver, and silver vacuum deposited through a mask, and then coated with an electrodeposit of copper from a copper sulfate solution followed by an electrodeposit of black chromium. The masks are produced by coating a beryllium-copper alloy substrate with a positive working photoresist, developing the photoresist to leave a positive mask, plating uncoated areas with gold, removing the photoresist, coating the substrate with a negative working photoresist, developing the negative working photoresist to expose the base metal of the pattern, and chemically etching the unplated side of the pattern to produce the mask. The mask is then used in the vacuum deposition of chromium and silver which is copper coated by electroplating. NASA

N73-19631*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL EQUATION DOCUMENT NO. 4: PRECISION STATE AND FILTER WEIGHTING MATRIX EXTRAPOLATION
William M. Robertson Jun. 1972 36 p refs Revised
(Contract NAS9-10268)
(NASA-CR-128803; Doc-4-Rev-2) Avail: NTIS HC $4.00 CSCL 17G

The Precision State and Filter Weighting Matrix Extrapolation Routine is described which provides the capability to extrapolate any spacecraft geocentric state vector either backwards or forwards in time through a force field consisting of the earth's primary central-force gravitational attraction and a superimposed perturbing acceleration. The routine also provides the capability of extrapolating the filter-weighting matrix along the precision trajectory. This matrix is a square root form of the error covariance matrix and contains statistical information relative to the accuracies of the state vectors and certain other optionally estimated quantities. The routine is a cooled algorithm for the numerical solution of modified forms of the basic differential equations which are statisfied by the geocentric state vector of the spacecraft's center of mass and by the filter-weighting matrix. Author

N73-19632# Joint Publications Research Service, Arlington, Va.
INTERIAL SYSTEMS
V. A. Karelin 7 Feb. 1973 30 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 15, no. 11, Nov. 1972 p 71-93
(JPRS-58181) Avail: NTIS HC $3.50

Articles are presented on the construction of frequency spectrum of three-stage gyroscope with flexible rotor shaft and elastic cardan suspension mounts; on systematic drift of gyroscope with variable kindtic moment in cardan suspension during oscillations of platform; condition of drift invariance of two-stage gyroscope with arbitrary gas lubricated main bearings to active accelerations; on the extremum problem of determining the plane of the meridian during the initial alignment of inertial systems; and on hydraulic damping of the sensors of differential manometers of dynamic pressure logs. For individual titles, see N73-19633 through N73-19637.

N73-19633 Joint Publications Research Service, Arlington, Va.
CONSTRUCTION OF FREQUENCY SPECTRUM OF THREE-STAGE GYROSCOPE WITH FLEXIBILE ROTOR SHAFT AND ELASTIC CARDAN SUSPENSION MOUNTS **c14**
V. A. Kareline *In its* Inertial Systems 7 Feb. 1973 p 1-7 refs (For availability see N73-19632 10-21)

The natural vibrations of a gyroscope with a flexible rotor shaft and elastic axial cardan suspension are examined. A method of constructing the natural frequency spectrum is described. Author

N73-19634 Joint Publications Research Service, Arlington, Va.
ON SYSTEMATIC DRIFT OF GYROSCOPE WITH VARIABLE KINETIC MOMENT IN CARDAN SUSPENSION DURING OSCILLATIONS OF PLATFORM **c14**
V. V. Savelyev *In its* Inertial Systems 7 Feb. 1973 p 8-12 refs (For availability see N73-19632 10-21)

The precesional motion of a three-stage astatic gyroscope on drift, installed on a platform, vibrating relative to two mutually perpendicular axes, is analyzed. Expressions are derived for the systematic drift of a gyroscope. The drift rate is determined by the rate of attenuation of rotor rpm and by vibration parameters. Author

N73-19635 Joint Publications Research Service, Arlington, Va.
CONDITION OF DRIFT INVARIANCE OF TWO-STAGE GYROSCOPE WITH ARBITRARY GAS-LUBRICATED MAIN BEARINGS TO ACTIVE ACCELERATIONS **c14**
S. G. Dadayev and G. A. Zavyalov *In its* Inertial Systems 7 Feb. 1973 p 13-17 refs (For availability see N73-19632 10-21)

The conditions are determined under which the drift of a two-stage gyroscope with arbitrary gas-lubricated main rotor bearings in the presence of arbitrary accelerations is equal to zero. Author

N73-19636 Joint Publications Research Service, Arlington, Va.
ON THE EXTREMUM PROBLEM OF DETERMINING THE PLANE OF THE MERIDIAN DURING THE INITIAL ALIGNMENT OF INERTIAL SYSTEMS
E. I. Sliv, Yu. A. Borisov, A. S. Ivanov, G. Z. Ilin, and Ye. V. Safonova *In its* Inertial Systems 7 Feb. 1973 p 18-22 ref (For availability see N73-19632 10-21)

Methods of determining the plane of the meridian for initial alignment of inertial systems are examined. It is found that when the characteristics of a stabilizer with a closed azimuthal channel are used for this purpose the drift of leveling gyroscopes has no effect on the accuracy of determination of the meridian. Author

N73-19637 Joint Publications Research Service, Arlington, Va.
ON HYDRAULIC DAMPING OF THE SENSORS OF DIFFERENTIAL MANOMETERS OF DYNAMIC PRESSURE LOGS **c14**
A. D. Kuznetsov and V. I. Yushchenko *In its* Inertial Systems 7 Feb. 1973 p 23-28 refs (For availability see N73-19632 10-21)

Possible methods of reducing the effect of external perturbations on the sensor of the dynamic pressure log by increasing the quality of its hydraulic damping are discussed. Author

N73-19638*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL EQUATION DOCUMENT NO. 19: PRELAUNCH ALIGNMENT AND PLATFORM COMPENSATION
James L. Gallagher Jul. 1972 27 p
(Contract NAS9-10268; DSR Proj. 55-40800)

(NASA-CR-128802) Avail: NTIS HC $3.50 CSCL 17G

The prelaunch-alignment program which aligns the stable platform to some desired orientation with respect to the local navigation reference frame is discussed. The alignment progresses in three distinct phases: coarse aligning, leveling, and gyrocompassing. While the program is in the leveling or gyrocompassing phase, a new launch azimuth may be specified without reinitiating the program. At liftoff, control is passed to a navigation monitor/control program. A description of the stable-platform-compensation program is included. The programs and equations given are similar to those used for Apollo. Author

N73-19639*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.

IN-FLIGHT ANGULAR ALIGNMENT OF INERTIAL NAVIGATION SYSTEMS BY MEANS OF RADIO AIDS

Walter Tanner Jun. 1972 44 p refs

(Contract NAS9-4065; DSR Proj. 55-23890)

(NASA-CR-128806; R-720) Avail: NTIS HC $4.25 CSCL 17G

The principles involved in the angular alignment of the inertial reference by nondirectional data from radio aids are developed and compared with conventional methods of alignment such as gyro-compassing and pendulous vertical determination. The specific problem is considered of the space shuttle reentry and a proposed technique for the alignment of the inertial reference system some time before landing. A description is given of the digital simulation of a transponder interrogation system and of its interaction with the inertial navigation system. Data from reentry simulations are used to demonstrate the effectiveness of in-flight inertial system alignment. Concluding remarks refer to other potential applications such as space shuttle orbit insertion and air navigation of conventional aircraft. Author

N73-19640# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE QUESTION OF CALCULATING THE LOCATION OF A VEHICLE IN GEOPOLAR REGIONS

K. G. Vakhitov [1972] 4 p refs Transl. into ENGLISH from Izvest. Vyssh. Ucheb. Zaved., Priborostr. (USSR), no. 10, 1972 p 96-99

Avail: NTIS HC $3.00, National Translations Center, John Crerar Library, Chicago, Ill. 60616

An orthopolar coordinate system which accounts for the ellipticity of the earth is examined, and formulas to convert it into a geographic system are derived. Author

N73-19641*# Analytic Sciences Corp., Reading, Mass.

ANALYSIS OF STRAPDOWN SENSOR TESTING Final Report

Bard S. Crawford 30 Jun. 1970 278 p refs

(Contract NAS12-678)

(NASA-CR-124126; TR-147-2) Avail: NTIS HC $16.00 CSCL 17G

Some topics related to dynamic testing of strapdown sensors are analyzed, with emphasis on measuring parameters which give rise to motion-induced error torques in single-degree-of-freedom inertial sensors. The objective is to determine the dynamic inputs, test equipment characteristics and data processing procedures best suited for measuring these parameters. Single axis, low frequency vibration tests and constant rate tests are studied in detail. Methods for analyzing the effects of test motion errors and measurement errors are developed and illustrated by examples. Candidate test data processing methods are compared and recommendations concerning test equipment and data processing are made. Author

N73-19642# Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.

KNOXVILLE ASSOCIATIVE PROCESSOR EVALUATION Final Report

B. G. Dietzler Nov. 1972 324 p

(Contract DOT-FA70WA-2289)

(PX-6406-Rev-A; FAA-RD-73-17) Avail: NTIS HC $18.25

An evaluation of the associative processor (AP) in performance of the tracking and conflict detection functions in a real-time terminal ATC environment is reported. Design data for the 1230 conflict resolution program and for all AP programs are included. A summary of the results is included. F.O.S.

N73-19643# Stanford Research Inst., Menlo Park, Calif.

COMPUTER-AIDED TRAFFIC/AIRWAY/VOR(TAC) NETWORK METHODOLOGIES. PART 1: TECHNIQUES OF AIR ROUTE NETWORK DESIGN (TASKS 1-3) Final Report, Feb. 1971 - Aug. 1972

Waheed Siddiqee Aug. 1972 153 p refs

(Contract DOT-FA71WA-2547; SRI Proj. 1096)

(FAA-RD-72-118-1-Pt-1) Avail: NTIS HC $9.75

The development of a computer-aided air route network design methodology is discussed. The subjects presented are: (1) establishment of route intersection points and angles, (2) establishment of various network attributes, (3) merging and bending routes, and (4) computer and plot programs. Mathematical models are presented to analyze the parameters which affect the computer program. Author

N73-19644# Stanford Research Inst., Menlo Park, Calif.

COMPUTER-AIDED TRAFFIC/AIRWAY/VOR(TAC) NETWORK METHODOLOGIES. PART 2: TECHNIQUES OF VORTAC GRID DESIGN (TASK 4) Final Report, Feb. 1971 - Aug. 1972

Waheed Siddiqee Aug. 1972 101 p refs

(Contract DOT-FA71WA-2547; SRI Proj. 1096)

(FAA-RD-72-118-2-Pt-2) Avail: NTIS HC $7.25

The development of a systematic methodology and associated computer programs for the optimal design of a national grid of high altitude VOR/VORTAC facilities is described. Various techniques, models, and computer operations are presented. The subjects include the following: (1) project scope, ground rules, and problem formulation, (2) the family of VORTAC grid attribute models, (3) design methodologies and techniques, and (4) program to implement a preliminary pattern shifting methodology. Author

N73-19645# Ohio Univ., Athens. Avionics Engineering Center.

INSTRUMENT LANDING SYSTEM IMPROVEMENT PROGRAM GRADIENT CLEARANCE MONITOR Final Report, 1 Jul. 1971 - 1 Oct. 1972

Michael J. Stefanik Oct. 1972 90 p refs

(Contract DOT-FA69WA-2066)

(FAA-RD-72-147) Avail: NTIS HC $6.50

Selected monitoring techniques to obviate the need for glide slope clearance flight checks have been identified. Of those investigated, the gradient clearance monitor concept appears to be the most promising technique for practical solution to the problem of ascertaining glide slope clearance signal. Feasibility is demonstrated through Fresnel zone commonality analysis and the design, fabrication, and experimental evaluation of the proposed monitor in operation with null-reference, glide-slope system. The results of this study are reported. Details include the development of three methods for the evaluation of gradient clearance monitor data involving both manual and computer solutions. Flight measurements to verify the monitoring of controlled, system faults have been used to investigate monitor credibility. A preliminary theoretical investigation indicates this monitoring concept is also compatible with sideband-reference and capture-effect systems. Results of this study support the concept of a far-field, environmental, glide-slope monitor. Author

N73-19646# Mitre Corp., McLean, Va.

CONTROLLER PRODUCTIVITY STUDY Final Report

R. A. Rucker, R. D. Parlow, P. R. Sterfels, and D. S. Mayer Feb. 1973 128 p refs

(Contract DOT-FA70WA-2488)

(MTR-6110; FAA-EM-73-3) Avail: NTIS HC $8.50

An analysis of the effects of automation on the productivity of air traffic control and flight services staffs over the next 10 to 20 years. It is concluded that an aggregate five percent per year productivity gain is achievable. The improvement will depend on an aggressive development and implementation plan. Author

N73-19647# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).

POSITION FINDING USING HYPERBOLIC COORDINATES Ph.D. Thesis - Stuttgart Univ. [ORTSBESTIMMUNG NACH HYPERBELKOORDINATEN]

Wolfgang Helble 1972 118 p refs In GERMAN

(Ser-C/Diss-176) Avail: NTIS HC $8.00

Methods are presented and improvements suggested for the transformation of hyperbolic coordinates into geographic and grid coordinates on conformal maps, and an objective comparison is made in order to establish the most suitable method. Formulas for transformation of hyperbolic coordinates into geographic coordinates by a direct method are based on a sphere as mathematical reference surface. The Razin method for mapping an ellipsoid surface on a sphere is discussed, as well as Gaussian conformal mapping. An iterative transformation method is discussed, and compared to the direct method. A direct method is proposed for conversion of hyperbolic coordinates into grid coordinates, used for Decca flight log maps. ESRO

N73-19648# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

STUDY OF A MODIFIED FLAT EARTH GUIDANCE LAW FOR THE EUROPA 3, PART 1

Helmut Bittner, O. Zielbauer, and Mueller 15 Oct. 1971 175 p refs Prepared for Arbeitsgemeinschaft Satellitentraeger-System (AS AT) Sponsored by ELDO

(MBB-TN-RE-11-93-71) Avail: NTIS HC $10.75

Two flat earth guidance versions were investigated for Europa 3. The first guidance law (referred to as MFEGL) is a modification of the guidance procedure used for the Europa 2 mission. The second guidance law (referred to as IGM) was used for the Apollo missions. The propulsion system requirements for injection were also investigated, as well as solutions for the optimal guidance problem. The results show that both guidance laws are fully applicable for the Europa 3 mission considered, i.e. for injection of the second stage into a 200 km circular parking orbit. Both guidance laws do not require off-line computation of numerical guidance correction functions, and the loss in payload as compared to the exact solution of the nonlinear two point boundary value problem is small. It is found that the modified flat earth guidance law version MFEGL seems to offer slight advantages in that this guidance law is able to cope with vehicle parameter perturbations better than the IGM. ESRO

N73-19649# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

STUDY OF A MODIFIED FLAT EARTH GUIDANCE LAW FOR THE EUROPA 3, PART 2

Helmut Bittner, O. Zielbauer, and J. Terceiro 20 Jul. 1972 284 p

(Contract ELDO-CTR-71/4/39)

(MBB-TN-RE-11-64-72-Pt-2) Avail: NTIS HC $16.25

Perturbation of vehicle parameters and second stage initial conditions, and a preliminary interpretation of the perturbation results with respect to the associated payload variation, as well as expected orbital parameter deviations are dealt with. Implementation of a vehicle parameter identification routine and evaluation of the improvement of guidance performance are discussed. Interaction of guidance law and vehicle dynamic performance, i.e. limited onboard computer resolution, guidance noise, and navigation accuracy are examined. Procedures and programs have been established, and a statistical assessment was carried out of navigation inaccuracies due to platform alignment and drift errors, in order to make preliminary assumptions on platform error model parameters. ESRO

N73-19650# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

TRANSLOCATION REFERENCE MANUAL

D. W. R. Denzler Jan. 1972 199 p refs

(Contract N00017-72-C-4401)

(AD-754173; APL-TG-1174) Avail: NTIS CSCL 17/7

The Navy Navigation Satellite System has been an operational element of the U. S. Navy since 1964. Since that date, it has provided world wide, all-weather, around-the-clock position data to ships at sea for navigation and to land users for survey and geodesy studies. The doppler shift, or apparent change in frequency of a stable source caused by relative motion between observer and source, is used in this system both in determination of the satellites and in navigation or survey and geodesy. The report has been compiled to provide a general description of the Navy Navigation Satellite System and a detailed description of the Translocation Subsystem and its operation. This material is presented on a level that can be understood by a high school graduate with a technical background. Author (GRA)

N73-19651# Ohio Univ., Athens. Dept. of Electrical Engineering.

DESIGN, CONSTRUCTION AND DEMONSTRATION OF AN AIRBORNE, LOW FREQUENCY, PHASE-STABLE RECEIVER

Frederick J. Kiko Oct. 1972 90 p refs

(Contract DAAB07-68-C-0084)

(AD-754027; EER-16-8; ECOM-0084-S-1) Avail: NTIS CSCL 17/7

Aircraft navigation using direct-ranging radio methods relies upon the processing of the carrier phase delay information accrued between a transmitter and a user. The first requirement following reception of the carrier wave is to raise its amplitude to a useable value. An RF filtering and amplification scheme using analog methods is invariably used whether detection and further processing is achieved by analog or digital methods. The primary design requirement for a navigation receiver for direct-ranging applications is throughput phase stability. In the elected design a fixed-tuned TRF cascade of LC filters and integrated circuit gain blocks exhibits a stability of one electrical degree in the LF band at 300 kHz with a one sigma standard deviation. Measured performance includes a 3 db overall bandwidth of 1.9 kHz, a noise figure of 6 db and a maximum voltage gain of 70 db.

Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-19652# Aerojet Nuclear Systems Co., Sacramento, Calif.

NERVA MASS PROPERTIES COMPUTER METHODOLOGY Engineering Operations Report

I. K. Hall 30 Mar. 1972 28 p

(Proj. 187)

(TID-26022) Avail: NTIS HC $3.50

The computer codes used for the weight, center of gravity, and mass moment of inertia calculations for the nuclear engine for rocket vehicles are presented. The computer programs allow for rapid weights estimates for new concepts and changes while allowing for orderly documentation. The capabilities and limitations of each program are described. Author

N73-19653# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

EXAMINATION OF IRRADIATED URANIUM NITRIDE FUEL CLAD WITH TUNGSTEN-RHENIUM OR T-111 ALLOY

D. R. Cuneo, E. L. Long, Jr., A. Jostsons, and T. N. Washburn Oct. 1972 46 p refs

(Contract W-7405-eng-26)

(ORNL-TM-3895) Avail: NTIS

Three fuel pins containing UN pellets were irradiated in the thermal neutron flux of the ORR for 5800 h to a peak burnup of 1.75 at.%. The pin with W-25% Re cladding performed satisfactorily with the cladding outer surface at 1300 C. The two pins with T-111 (Ta-8% W-2% Hf) cladding, which had an inner liner of chemically vapor deposited tungsten, operated with the cladding outer surface at 1400 C. The T-111 on one of the pins failed during the test by intergranular fracture. The grain size in the failed region was 6 times that in the gas plenum region. Numerous cracks and cavities were found in other regions of the T-111 cladding of both the failed and unfailed pins. Hafnium-rich areas, with concentrations 30 to 40 times that in the homogeneous alloy, were detected by electron microprobe examination at the cracks and cavities in both the T-111 and the tungsten liner. The mechanism of the test-induced concentration of hafnium was not determined. Author (NSA)

N73-19654# California Univ., Livermore. Lawrence Livermore Lab.

LASER POSSIBILITIES IN PULSED CONTROLLED THERMONUCLEAR FUSION

J. W. Shearer 24 Aug. 1972 20 p refs Presented at Conf. of the Cryog. Soc. of Am., Chicago, 3 Oct. 1972
(UCRL-73931; Conf-721023-1) Avail: NTIS

It has been proposed to use a laser to heat a deuterium plasma in a uniform magnetic field similar to conventional fusion machine concepts. Large cryogenically cooled coils would be needed to provide fields of a hundred kilogauss or greater. Another suggestion is that small thermonuclear microexplosions be created in a thick-walled vacuum chamber means of a spherical array of laser beams focused on small spherical pellets of solid heavy hydrogen. These pellets must be prepared cryogenically and propelled into the vacuum chamber. This controlled-fusion concept does not require a magnetic field for containment because the pellet plasma is so dense that sufficient nuclear reactions occur before it comes apart. The proposal involves questions of explosion magnitude and repetition rate, efficiencies of laser operation and light absorption, and energy recovery. Author (NSA)

N73-19655# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
THERMAL SIMULATION OF FUEL RODS BY INDIRECTLY ELECTRICALLY HEATED RODS
S. Malang and K. Rust May 1972 47 p refs Sponsored by US-EURATOM
(EURFNR-1026; KFK-1587) Avail: NTIS

The example of a rod eccentrically arranged in an annulus with sodium flow was used to investigate the accuracy with which it is possible to simulate the conditions existing in an oxide fuel rod by indirectly electrically heated rods of different geometry. For this purpose, the temperature field in the rod and in the cooling channel is calculated. The comparison is made under the assumption of a fully developed temperature profile at slug slow and pure thermal conduction in the coolant. Several theoretical assumptions often made of a constant heat flux or a constant temperature at the inner or outer surface of the cladding are included in the investigation. The study covers the influences of the material and the thickness of the electrical insulation as well as of the cladding on the quality of the simulation. Furthermore the consequences of fabrication tolerances are considered. Author (NSA)

N73-19656# Reactor Centrum Nederland, Petten.
FAST REACTOR PROGRAMME Quarterly Progress Report, 1972
E. K. Hoekstra, comp. Aug. 1972 70 p refs
(EURFNR-1034; RCN-173; QPR-2) Avail: AEC Depository Libraries

The RCN program comprising reactor physics, fuel irradiations, advanced fuels, radiation damage in canning materials, analysis of impurities in sodium, aerosol research, heat transfer, and hydraulics is reviewed. Author (NSA)

N73-19657# European Atomic Energy Community, Karlsruhe (West Germany).
ROLE OF CAESIUM IN CHEMICAL INTERACTION OF AUSTENITIC STAINLESS STEELS WITH URANIUM PLUTONIUM OXIDE FUELS
R. W. Ohse and M. Schlechter 22 Aug. 1972 27 p refs
(EUR-4893) Avail: AEC Depository Libraries; EUR B. Fr. 40

The role of cesium in fuel-cladding interaction of austenitic stainless steels with mixed oxide fuels is discussed by considering the phase relationships, oxygen potentials, and defect structures of the oxide layers and the oxygen containing liquid multi component cesium phase. The possible reaction mechanisms of the various kinds of attack, the formation of a layered structure, the surface ablation of steel or matrix attack, and the intergranular attack are discussed. The initial alloy oxidation state of the stainless steels, obtained by the formation of a passivating oxide scale is considered on the basis of the chromium content, the constitution diagram and the oxygen partial pressure at the fuel surface. Dissolution of the oxide components at high burnup in the oxygen containing liquid cesium phase by oxygen exchange reactions gives a reasonable explanation for changes in oxidation rate caused by changes in defect concentration. Author (NSA)

N73-19658# Oak Ridge National Lab., Tenn.
ISOTOPIC POWER FUELS Monthly Status Report, Oct. 1972
Eugene Lamb Nov. 1972 5 p
(Contract W-7405-eng-26)
(ORNL-TM-4035) Avail: NTIS

Progress on the development of Cm-244 for isotopic power fuels is reported. Work continued on procurement of materials and other test-system components for the Cm2O3 compatibility program. A short-term compatibility experiment was performed between SiC and CmO2. Progress on vapor transport of Cm2O3 is also reported. NSA

N73-19659# Defense Nuclear Agency, Washington, D.C.
FUNDAMENTAL BLAST STUDIES Final Report
Louis Giglio-Tos 22 Dec. 1972 78 p refs
(AD-753805; DNA-POR-6744; AEC-WT-6744) Avail: NTIS CSCL 18/3

Free-field airblast parameters were measured from the detonation of a spherical 500-ton TNT charge. The charge was placed on the ground such that its height of burst would be one radius above the earth's surface. Measured values of shock-wave arrival time, maximum overpressure, positive phase duration, overpressure impulse, dynamic pressure, and dynamic pressure impulses are presented as functions of ground range and are compared with predictions generated from scaled empirical and theoretical data. Results are compared with those from PRAIRIE FLAT. Author (GRA)

N73-19660# Naval Research Lab., Washington, D.C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 Aug. - 31 Oct. 1972
L. E. Steele, ed. 15 Nov. 1972 51 p refs
(Contract AT(49-5)-2110; MIPR-ERG-41004; NRL Proj. M01-14; NRL Proj. M01-22; NRL Proj. M01-27; RR0221141)
(AD-753457; NRL-MR-2531) Avail: NTIS CSCL 18/10

The research program of the NRL Metallurgy Division, Reactor Materials Branch, involves a broad study of the effects of nuclear radiation upon materials. The report, covering research for the period 1 Aug-31 October 1972, includes: J-integral characterization of irradiated 304 stainless steel; Studies of fatigue crack propagation in neutron irradiated stainless steel weldments; Exploratory assessments of A508 forging radiation resistance; A parametric study of the vacancy trapping during irradiation; Surveillance results for the MH-1A reactor pressure vessel.
Author (GRA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-19661 Wesleyan Univ., Middletown, Conn.
A SEARCH FOR ANISOTROPY IN THE SPEED OF LIGHT Ph.D. Thesis
William Stuart Newberry Trimmer 1972 141 p
Avail: Univ. Microfilms Order No. 72-24266

The interferometer described in this investigation detects anisotropies in the speed of light. The method utilizes the principles of light beam direction angles, direction of light propagation, and the average speed of light, to determine the size of the anisotropy. The ratio between the change in the speed of light and its average speed is discussed. In addition, the sensitivity of the interferometer is described as well as its improved effectiveness in either wind testing. Dissert. Abstr.

N73-19662# Politecnico di Milano (Italy). Brescia Engineering Faculty.
[RESEARCH IN THEORETICAL PHYSICS]
Bruno Finzi Dec. 1971 54 p refs In ITALIAN
(Publ-100) Avail: NTIS HC $4.75

Articles concerning physical phenomena in electromagnetism, relativity, and the unity theory are presented. For individual titles, see N73-19663 through N73-19665.

N73-19663 Politecnico di Milano (Italy).
THE THREE LAWS OF DYNAMICS [LE TRE LEGGI DELLA

DINAMICA]
In its Res. in Theoret. Phys. Dec. 1971 p 5-14 In ITALIAN
(For availability see N73-19662 10-23)

The law of inertia, Newton's fundamental law, and the law of action and reaction which are considered the dynamic laws, are examined in the Kirchoff and Lagrange schemes.
Transl. by F.O.S.

N73-19664 Politecnico di Milano (Italy).
PRINCIPLE OF VIRTUAL WORK [PRINCIPIO DEI LAVORI VIRTUALI]
In its Res. in Theoret. Phys. Dec. 1971 p 15-34 In ITALIAN
(For availability see N73-19662 10-23)

Equilibrium is discussed in terms of virtual work and displacement. Topics discussed include: principle, and analytic expressions of static virtual work; equations for mechanical equilibrium; principle of minimum potential of active energy; dynamics of virtual work; conservation of energy; Hamiltonian principle; and physical equilibrium. Transl. by F.O.S.

N73-19665 Politecnico di Milano (Italy).
THE CARDINAL EQUATION OF DYNAMICS [LE EQUAZIONI CARDINALI DELLA DINAMICA]
In its Res. in Theoret. Phys. Dec. 1971 p 35-53 In ITALIAN
(For availability see N73-19662 10-23)

The cardinal equations are presented which express the theorems for the quantity of motion (vectors), momentum (vectors), and the principles of energy (scalers). The cardinal equations are derived for: the fundamental dynamic laws (Newton's second law) for each body of the system; the law of action and reaction (the third law of Newton); and for the principles of thermodynamics. Transl. by F.O.S.

N73-19666# National Aeronautical Establishment, Ottawa (Ontario).
A SIMPLE MODEL OF SHOCK CELL NOISE GENERATION AND ITS REDUCTION
Y. Y. Chan Oct. 1972 46 p refs
(NRC-12923; LR-564) Avail: NTIS HC $4.50

Based on the data of near field surveys of the sound pressure from a choked jet, a simple model is proposed for the mechanism of the screech generation. A convected wave propagates downstream along the jet boundary and is modulated by its interactions with the shock-expansion waves of the jet. These interactions generate strong dipole radiations. Using this model, an excellent reproduction of the essential features of the experimental results is obtained. By preventing the formation of shock waves inside the jet, the strong dipole radiation and hence the screech noise can be eliminated. Design data for perforated nozzles to achieve full expansion of the jet are provided. This avoids the mechanical complication of an adjustable convergent-divergent nozzle. Author

N73-19667# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETERMINATION OF THE THICKNESS AND RADIUS OF A SPHERICAL SHELL BY ECHO SIGNALS
Is. A. Metsaveer and U. K. Nigul [1972] 8 p refs Transl. into ENGLISH from Inzh. Zh., Mekh. Tverd. Tela (USSR), no. 6, 1972 p 60-66
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Sound echo signals from an elastic spherical shell produced by a sinusoidal sounding pulse of finite length in an infinite ideal compressible fluid are considered. Mathematical models of the echo signals were used to determine the following: the frequency range of the sounding pulse at which the elastic strain of the shell has influence on the structure and amplitude of the echo signal; the frequency bands at which the echo signal from an elastic shell differs slightly from those of a rigid sphere of the same radius; a selection of the frequency of the sinusoidal sounding pulse from the range of strong influence of the elastic strain of the shell on the echo signal, to determine the distance to the shell, its radius, and its thickness. J.M.M.

N73-19668# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ON BIREFRINGENCE PHENOMENA ASSOCIATED WITH TOTAL REFLECTION
B. Julia and A. Neveu Sep. 1972 19 p refs
(LPTHE-72/39) Avail: NTIS HC $3.00

The birefringence properties of total reflection of a light beam at the separation plane, between two isotropic homogeneous media are studied by the phase shift method. This includes the Goose Hanchen longitudinal effect in which a source of unpolarized light is split into two images, each of them linearly polarized, as well as the transverse shift recently investigated experimentally by Imbert, where the effect is between left and right circular polarizations. A general simple method is given for determining the polarizations and positions of the images. Author

N73-19669*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFRARED AND MICROWAVE MEASUREMENTS ACROSS THE ITC
Raymond Wexler Mar. 1973 18 p refs
(NASA-TM-X-66203; X-651-73-61) Avail: NTIS HC $3.00 CSCL 20N

Analysis is presented of data obtained from Nimbus 3 infrared measurements of the Intertropical Convergence Zone (ITC) over the tropical oceans. The ITC is characterized by a cloud belt with a varied structure of single to double lines or clusters along latitudes 0 to 10N depending on the season. The infrared radiometers in the Nimbus satellite provided data for interpreting relative cloud heights and fields of vertical motions in the ITC. Supplementary aircraft measurements with infrared and microwave radiometers during the Nimbus 3 overpass are also anylyzed.
Author

N73-19670*# Itek Corp., Lexington, Mass. Central Research Labs.
FOURIER PLANE FILTERS Final Project Report
Donald S. Oliver, Ralph E. Aldrich, and Franics T. Krol Nov. 1972 64 p refs
(Contracts NAS5-11486; NAS5-11475; Proj. 9656)
(NASA-CR-130185) Avail: NTIS HC $5.25 CSCL 20F

An electrically addressed liquid crystal Fourier plane filter capable of real time optical image processing is described. The filter consists of two parts: a wedge filter having forty 9 deg segments and a ring filter having twenty concentric rings in a one inch diameter active area. Transmission of the filter in the off (transparent) state exceeds fifty percent. By using polarizing optics, contrast as high as 10,000:1 can be achieved at voltages compatible with FET switching technology. A phenomenological model for the dynamic scattering is presented for this special case. The filter is designed to be operated from a computer and is addressed by a seven bit binary word which includes an on or off command and selects any one of the twenty rings or twenty wedge pairs. The overall system uses addressable latches so that once an element is in a specified state, it will remain there until a change of state command is received. The drive for the liquid crystal filter is ± 30 V peak at 30 Hz to 70 Hz. These parameters give a rise time for the scattering of 20 msec and a decay time of 80 to 100 msec. Author

N73-19671*# Itek Corp., Lexington, Mass. Central Research Labs.
OPTICAL TO OPTICAL INTERFACE DEVICE Final Project Report, Jun. 1971 - Feb. 1972
Donald S. Oliver, Paul Vohl, and Peter Nisenson Nov. 1972 83 p refs
(Contract NAS5-11475)
(NASA-CR-130183) Avail: NTIS HC $6.25 CSCL 20F

The development, fabrication, and testing of a preliminary model of an optical-to-optical (noncoherent-to-coherent) interface device for use in coherent optical parallel processing systems are described. The developed device demonstrates a capability for accepting as an input a scene illuminated by a noncoherent radiation source and providing as an output a coherent light beam spatially modulated to represent the original noncoherent scene. The converter device developed under this contract employs a Pockels readout optical modulator (PROM). This is a photosensitive electro-optic element which can sense and electrostatically store optical images. The stored images can be simultaneously or subsequently readout optically by utilizing the electrostatic storage pattern to control an electro-optic light modulating property of the PROM. The readout process is parallel

as no scanning mechanism is required. The PROM provides the functions of optical image sensing, modulation, and storage in a single active material. Author

N73-19672*# Grumman Aerospace Corp., Bethpage, N.Y.
A STUDY OF THE DYNAMICS OF ROTATING SPACE STATIONS WITH ELASTICALLY CONNECTED COUNTER-WEIGHT AND ATTACHED FLEXIBLE APPENDAGES. VOLUME 1: THEORY Final Report
Fred Austin, Joel Markowitz, Stephen Goldenberg, and George A. Zetkov Mar. 1973 391 p 2 Vol.
(Contract NAS1-10973)
(NASA-CR-112243) Avail: NTIS HC $21.75 CSCL 20K

The formulation of a mathematical model for predicting the dynamic behavior of rotating flexible space station configurations was conducted. The overall objectives of the study were: (1) to develop the theoretical techniques for determining the behavior of a realistically modeled rotating space station, (2) to provide a versatile computer program for the numerical analysis, and (3) to present practical concepts for experimental verification of the analytical results. The mathematical model and its associated computer program are described. Author

N73-19673*# Grumman Aerospace Corp., Bethpage, N.Y.
A STUDY OF THE DYNAMICS OF ROTATING SPACE STATIONS WITH ELASTICALLY CONNECTED COUNTER-WEIGHT AND ATTACHED FLEXIBLE APPENDAGES. VOLUME 2: COMPUTER PROGRAM USER'S MANUAL Final Report
Eugene J. Lowe and Fred Austin Mar. 1973 431 p 2 Vol.
(Contract NAS1-10973)
(NASA-CR-112244) Avail: NTIS HC $23.75 CSCL 20K
For abstract see N73-19672

N73-19674*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF PARALLACTIC REFRACTION CORRECTION ON STATION HEIGHT DETERMINATION
Francis J. Lerch and Herbert A. Huston (Computing and Software, Inc.) Jan. 1973 27 p refs
(NASA-TM-X-66208; X-592-73-31) Avail: NTIS HC $3.50 CSCL 17H

The effect of omitting the parallactic refraction correction for satellite optical observations in the determination of station coordinates is analyzed for a large satellite data distribution. A significant error effect is seen in station heights. A geodetic satellite data distribution of 23 close earth satellites, containing 30,000 optical observations obtained by 13 principal Baker-Nunn camera sites, is employed. This distribution was used in a preliminary Goddard Earth Model (GEM 1) for the determination of the gravity field of the earth and geocentric tracking station locations. The parallactic refraction correction is modeled as an error on the above satellite data and a least squares adjustment for station locations is obtained for each of the 13 Baker-Nunn sites. Results show an average station height shift of +8 meters with a dispersion of plus or minus 0.7 meters for individual sites. Station latitude and longitude shifts amounted to less than a meter. Similar results are obtained from a theoretical method employing a probability distribution for the satellite optical observations. Author

N73-19675# California Univ., Livermore. Lawrence Livermore Lab.
MAGNITUDE AND EXTENDED ENERGY RANGE OF X-RAY K-ABSORPTION FINE STRUCTURE FOR Ti, Fe, Co, Ni, Cu, AND Zn
N. K. DelGrande and A. J. Oliver Apr. 1972 23 p refs Presented at Intern. Symp. on X-ray Spectra and Electron. Struct. of Matter, Munich, 18-22 Sep. 1972 Sponsored by AEC
(UCRL-73923; Conf-720939-1) Avail: NTIS

Total X-ray attenuation coefficients for six elements from Ti-Zn were measured from approximately 100 eV below to approximately 900 eV above their respective X-ray K absorption edges. A smooth average through the data taken at approximately less than 5 eV intervals was systematically about 10 percent higher at energies approaching the K absorption edge from the high energy side than perdictions based on atomic theory for the elements Ti, Fe, Co, Ni, Cu and Zn. Agreement was 3 percent or better at higher energies with predictions obtained numerically beginning with Hartree-Fock-Slater type screened central potentials. Author

N73-19676# Royal Inst. of Tech., Stockholm (Sweden).
COLLECTIVE PHENOMENA IN A PENNING DISCHARGE IN A STRONGLY INHOMOGENEOUS MAGNETIC FIELD
N. Hopfgarten, R. B. Johansson, B. H. Nilsson, and H. Persson Mar. 1972 51 p refs
(TRITA-EPP-72-13) Avail: AEC Depository Libraries

In an attempt to study electric field components along the magnetic field in a collision-free plasma, to simulate the conditions in a geomagnetic flux tube, and to produce energetic ions, a pulsed Penning discharge was run in hydrogen gas of 1 to 40 x 0.0001 torr pressure. Two cathodes were located in the mirrors and an anode in the midplane of a strongly inhomogeneous magnetic mirror field. Measurements of plasma particles, cathode heating, microwave emission, time-integrated light, diamagnetic and Langmuir probe signals, and of the electrical characteristics of the discharge were performed. The measurements show that there exists in the plasma body a potential difference of 1 to 2 kV, distributed along the magnetic field. The ion temperature in this region is 1 to 3,000,000 K. Under certain conditions a pronounced spatial variation of the neutral-particle emission is observed, suggesting a collision-free shock of sheath structure.
Author (NSA)

N73-19677# Los Alamos Scientific Lab., N.Mex.
RADIATION-HARDENED MAGNETS USING MINERAL INSULATED CONDUCTORS
A. Harvey 1972 13 p refs Presented at 4th Intern. Conf. on Magnet Technol., Upton, N. Y., 19 Sep. 1972 Sponsored by AEC
(LA-DC-72-1106; Conf-720908-7) Avail: NTIS

A unique feature of the LAMPF high-intensity linac experimental area is the extensive use of inorganic magnet coils to withstand the high radiation doses. The coil insulation is compacted magnesium oxide powder (mineral insulation, m.i.) and preinsulated cable is wound into the required coil configuration. Although the cable itself is expensive compared to bare copper conductor, the finished coil cost is comparable to a conventional coil, since no insulation application is required of the coil winder. Two conductor formats are used at LAMPF: solid conductor, externally cooled, using soft solder to improve the heat transfer within the coil and directly cooled, hollow conductor m.i. cable. At LAMPF both conductor types are conservatively rated. Indirectly cooled coils are used exclusively in the switchyard magnets, where low field strengths and high quality are required. Higher-power magnets for target-to-target transport and secondary beam lines use direct cooling. Author (NSA)

N73-19678# Iowa State Univ. of Science and Technology, Ames.
HIGH, MEDIUM, AND LOW ENERGY PHYSICS, MATHEMATICS AND COMPUTER, CHEMISTRY, AND METALLURGY AND MATERIALS RESEARCH Annual Summary Report, Progress and Plans, 1971
Nov. 1972 138 p refs
(Contract W-7405-eng-82)
(IS-2800) Avail: NTIS

Abstracts of published experimental and theoretical research in high energy and nuclear physics, mathematics and computers, chemistry, metallurgy and materials, and solid state physics are presented. Author (NSA)

N73-19679# Addis Translations International, Woodside, Calif.
ADIABATIC PROCESSES IN A SPIRAL MAGNETIC FIELD
A. G. Bonch-Osmolovskii Oct. 1972 14 p refs Transl. into ENGLISH from JINR report, JINR-P9-6464 Prepared for UCRL, Berkeley
(UCRL-Trans-1487; JINR-P9-6464) Avail: NTIS

In a preceding work it was noted that when electrons revolve in a weakly focusing magnetic field the betatron oscillation frequencies are considerably affected if an azimuthal component of the magnetic field is introduced. It was postulated that if a charged ring is formed in such a field its small dimensions can be appreciably changed. Recently it has been shown that under certain conditions in a spiral weakly focusing field the conditions of passing dangerous one-particle resonances on ring compression

are greatly improved. The aim of the present work was to study, within the framework of the problem with a self-consistent field, the behavior of a charged electron ring in a spiral magnetic field varying adiabatically in time. Use is made of a method proposed by Yarkova. Author (NSA)

N73-19680# Johns Hopkins Univ., Baltimore, Md.
ACOUSTIC EMISSION AND THE PORTEVIN-LE CHATELIER EFFECT Progress Report, 1 Mar. - 1 Nov. 1972
W. F. Hartman 1972 6 p refs
(Contract AT(11-1)-2204)
(COO-2204-1) Avail: NTIS

The discontinuous yielding during tensile loading of many crystalline solids results in a serrated or steplike stress-strain curve and is known at the Portevin-Le Chatelier effect. Replicable features of the discontinuous yielding of dead-weight loaded annealed specimens of several FCC materials were documented and compared with the acoustic emission accompanying such deformation. It was found that the energy of the acoustic emission during a yield increment correlates with the elastic energy stored since the last yield increment. Author

N73-19681# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
INFLUENCE OF MAGNETOACOUSTIC OSCILLATIONS ON ELECTROMAGNETIC OF SHEAR ACOUSTIC WAVES
M. R. Gaerttner and B. W. Maxfield May 1972 16 p refs Sponsored by ARPA
(Contract AT(11-1)-3150)
(COO-3150-4) Avail: NTIS

An oscillatory, nonlocal contribution to the electromagnetic generation of shear acoustic waves in metals was observed when the magnetic field is perpendicular to the propagation direction. Previous observations of electromagnetic generation of shear acoustic waves were limited to the field being parallel to the propagation direction. The observations are explained by considering forces on the lattice that arise from both the directly induced skin depth electric field and the electric fields due to Gantmakher splash current sheets. Author

N73-19682# Argonne National Lab., Ill.
COMPUTATION OF MAGNETIC END FIELDS, AND COMPARISON WITH MEASUREMENT
H. F. Vogel (LASL) and R. J. Lari 1972 8 p refs Presented at 4th Intern. Conf. on Magnet Technol., Upton, N. Y., 19 Sep. 1972 Sponsored by AEC
(LA-DC-72-1121; Conf-720908-13) Avail: NTIS

The dependence of the magnetic effective length and the fringe field correction constant on the central field flux density are of particular interest in designing beam transport systems. It is therefore important to know the accuracy with which they may be calculated. Measurements on Argonne's bending magnet BM-111 were compared with TRIM computations. The agreement between computed and measured effective lengths was within 1.7 percent in pole separation units for fields from 0 to 17 kG. The agreement between computed and measured fringe field correction constant, which determines the correction angle to the transverse focal length, was within 0.56 percent of the measured value of 8 kG. Author (NSA)

N73-19683# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
MEASUREMENT OF THE MAGNETIC SUSCEPTIBILITY TENSOR FOR FERRIMAGNETIC POLYCRISTALLINE MATERIALS SATURATED IN THE X-BAND Final Report [ETUDE DE LA MESURE DU TENSEUR DE SUSCEPTIBILITE MAGNETIQUE DE MATERIAUX FERRIMAGNETIQUES POLYCRISTALLINS A L'ETAT SATURE EN BANDE X RAPPORT DE FIN D'ETUDES]
R. Sroussi 28 Sep. 1971 20 p refs In FRENCH
(Rept-9.441) Avail: NTIS HC $3.00

Components of the saturated state magnetic sensitivity tensor for spinel and garnet type ferrimagnetic materials were measured in the X band. Materials for the development of the test bed must have a magnetic value in the range 300 to 5000 gauss and a gyroresonance bandwidth in the range 30 to 600 oersteds. Materials with a grain size between 1 and 5 microns were also measured. ESRO

N73-19684# Fraunhofer-Gesellschaft zur Forderung der Angewandten Forschung e. V., Freiburg (West Germany). Inst. fuer Angewandte Festkoerperphysik.
THE SELECTIVE OPTICAL REFLECTION BEHAVIOR OF CHOLESTERIC LIQUID CRYSTALS [DAS SELEKTIVE OPTISCHE REFLEXIONSVERMOEGEN CHOLESTERINISCHER FLUESSIGKRISTALLE]
R. Dreher Bonn Bundeswehramt 1972 105 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-72-27) Avail: NTIS HC $7.25; Bundeswehramt, Bonn: 25 DM

Various possible models for the structure of cholesteric liquid crystals are discussed. It is shown that only one of these models exhibits properties that are in agreement with experiment: a uniformly twisted structure which is locally uniaxial. A general theory of the optical properties of cholesteric liquid crystals was developed for light incident at an arbitrary angle. This theory shows that amplitude modulated waves can propagate in the twisted structure but that there are certain forbidden frequency bands. The conditions for selective reflection can be directly seen from a stability diagram. Experimental verification of the theoretical results is dealt with. It is shown that well-oriented cholesteric liquid crystal samples can be prepared. The study of the selective reflection bands for increasing angle of incidence verifies the shift of the main reflection band and the predicted splitting into two bands as well as the occurrence of one of the additional higher order reflection bands. Author (ESRO)

N73-19685# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATIONS TO ELECTROMAGNETISM AND FLUID MECHANICS [CHAMPS MERIDIENS. APPLICATIONS A L'ELECTROMAGNETISME ET LA MECHANIQUE DES FLUIDES]
Robert Legendre 1972 42 p In FRENCH; ENGLISH summary
(ONERA-NT-207) Avail: NTIS HC $4.25

A method for describing axisymmetric fields which satisfy a Laplace equation is proposed. It is based on the preliminary computation of elementary fields explicitly defined by very simple formulas. Conventional elementary fields of sources distributed on a circle and the circular vortex are compared with these fields. The regular elementary fields are mentioned. The new elementary fields are used for describing axisymmetric fields constrained by various boundary conditions. Author (ESRO)

N73-19686# Army Tropic Test Center, APO New York 09827.
JUNGLE ACOUSTICS 3: EFFECTS OF AN ACOUSTIC FILTER ON THE DETECTION OF VOICES THROUGH THE JUNGLE CANOPY Final Report
Delaney A. Dobbins and Adrian U. Dubuisson Jul. 1972 32 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-753650; USATTC-7209001) Avail: NTIS CSCL 20/1

The United States Army Tropic Test Center conducted a study of auditory detectability of human voices from the jungle floor through the canopy in the Panama Canal Zone during October and November 1970 (wet season) and April 1971 (dry season). A total of 240 transmissions were made from a speaker system to acoustic sensors at heights ranging from 5 to 100 feet. Voice transmissions were conducted at slant range distances from 600 to 1200 feet from sensors. The recorded transmissions were later played back to a total of 60 soldiers from TOE units under two conditions-filtered and unfiltered. The soldier listeners attempted to distinguish human vocies from natural jungle ambient noises. The study demonstrated that filtering and vertical sensor position have a significant impact on the detection capabilities of an acoustic sensor system tested or operationally deployed in jungle areas. Author (GRA)

N73-19687# Stevens Inst. of Tech., Hoboken, N.J. Cryogenics Center.
THERMO-ELECTRICITY AND REFRIGERATION AT LOW TEMPERATURES Annual Report, 1 Jan. - 31 Dec. 1972
John G. Daunt 31 Dec. 1972 50 p refs
(Contract N00014-67-A-0202-0027)
(AD-753405) Avail: NTIS CSCL 07/4

The research programs of the center are briefly described. They deal with the following: Thermoelectricity at very low temperatures; Physics of adsorbed gas layers and desorption refrigeration; and Experimental studies of cryogenic refrigeration. GRA

N73-19688# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
NON-EQUILIBRIUM RELAXATION METHODS. ACOUSTIC EFFECTS IN TRANSIENT CHEMICAL REACTIONS
P. Ortoleva, R. Gilbert, and John Ross Nov. 1972 44 p refs Prepared in cooperation with Mass. Inst. of Tech., Cambridge.
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-753798; SQUID-TR-MIT-71-PU) Avail: NTIS CSCL 07/4

The hydrodynamic equations of motion describing the interaction of sound with transient chemical reactions are written for adiabatic conditions to take account of changes in enthalpy and stoichiometry, and the possibility of temperature and pressure dependent rate coefficients. The equations are linearized in small inhomogeneous perturbations away from the time-dependent homogeneous state of the reacting system and solved by asymptotic expansion methods in the limit of high acoustic frequencies. Details are given for the ideal gas reactions A to B + C, A to B. Numerical solutions of the hydrodynamic equations of motion confirm the predictions of the theory quantitatively. The theory is developed for standing acoustic waves and propagating wave packets. GRA

N73-19689# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OPTICAL BEAM SPREAD IN A TURBULENT MEDIUM: THE EFFECT OF THE OUTER SCALE OF TURBULENCE, JULY - AUGUST 1972
Hal T. Yura 15 Jan. 1973 17 p refs
(Contract F04701-72-C-0073)
(AD-754204; TR-0073(3230-30)-1; SAMSO-TR-72-297) Avail: NTIS CSCL 20/6

On the basis of the extended Huygens Fresnel principle, a simple derivation of the effects of the outer scale of turbulence on the turbulence-induced beam spread of an optical beam propagating through a random medium is given. The analysis is valid for all propagation distances of interest. Analytic and numerical results are presented such that the limitations on previous results are obtained. Author (GRA)

N73-19966 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
A MODEL FOR THE INHERENT CONTRAST CONDITIONS IN FULL-FORM OBJECTS
Max R. Nagel *In* AGARD Air to Ground Target Acquisition Nov. 1972 21 p refs (For availability see N73-19959 10-34)

N73-19968 Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Environments Branch.
AIR-TO-GROUND TARGET ACQUISITION WITH FLARE ILLUMINATION
Robert L. Hilgendorf IN AGARD Air to Ground Target Acquisition Nov. 1972 11 p refs (For availability see N73-19959 10-34)

N73-19978* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
THERMOLUMINESCENCE: POTENTIAL APPLICATIONS IN FORENSIC SCIENCE
J. D. Ingham and D. D. Lawson *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 18-28 refs (For availability see N73-19975 10-34)
CSCL 20J

N73-19984* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
HELICOPTER VISUAL AID SYSTEM
R. L. Baisley *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 72-86 ref (For availability see N73-19975 10-34)
CSCL 20F

N73-19042 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
RESEARCH ON CRYOGENICS AND INDUCTIVE ENERGY STORAGE AT THE DFVLR
C. Carpetis *In* AGARD Energetics for Aircraft Auxiliary Power systems Feb. 1972 7 p refs (For availability see N73-19030 10-03)

N73-19043 Centre d'Etudes et Recherches de la Compagnie Electro-Mecanique, Le Bourget (France). Groupe d'Etudes Cryotechniques.
NONRADIATING SUPERCONDUCTING COILS FOR ENERGY STORAGE
M. Gayte, B. Girard, and A. Malandain *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 6 p refs (For availability see N73-19030 10-03)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-19690# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
INFLUENCE OF INTERATOMIC REPULSION ON THE STRUCTURE OF LIQUIDS AT MELTING
Jean-Pierre Hansen and Daniel Schiff Nov. 1972 25 p refs Sponsored by CNRS
(LPTHE-72/45) Avail: NTIS HC $3.25

Radial distribution functions and liquid structure factors for fluids or particles interacting through $1/r$ to the nth power repulsive potentials are computed and systematically compared at crystallization for several values of n. These values range between the two extremes of hard spheres (n = to infinity) and Coulomb forces (n = 1). Striking similarities are pointed out in the large r behavior (beyond the first peak) of the various radial distribution functions, and in the small k behavior (including the first peak) of the various structure factors. Some information is gained about the steepness of the repulsive potential in liquid rare gases and in liquid alkalis from a comparison of the damping of successive peaks of the structure factors with experimental data. Author

N73-19691# Laboratoire de Physique Theorique et Particules Elementaires, Orsay (France).
WHAT CAN BE LEARNED FROM INCLUSIVE ANTIPROTON SPECTRA?
A. Krzywicki and B. Peterson Jan. 1973 13 p refs Sponsored by CNRS Prepared in cooperation with Lab. de Phys. Theorique et Hautes Energies, Orsay, France
(LPTHE-73/1) Avail: NTIS HC $3.00

An explanation is presented for the increase with energy of the antiproton yield, and a description is given of antiproton rapidity distributions at interacting storage rings (isr) energies. In addition, discussion is made regarding the antiproton one-particle inclusive spectra at isr energies as revealing important factors of the multiparticle production dynamics. J.M.M.

N73-19692# Royal Inst. of Tech., Stockholm (Sweden).
INTEGRABLE AND NONINTEGRABLE LIE-ALGEBRA REPRESENTATIONS WITH APPLICATIONS TO PARTICLE PHYSICS Ph.D. Thesis
Hakan Snellman 1972 15 p refs Sponsored in part by Statens Rad foer Atomforskning and CNRS
Avail: NTIS HC $3.00 CSCL 20H

A search for groups or algebras that describe the dynamics of physical systems is described. As such the investigation treats the phenomena of particle physics as lying within the framework of quantum mechanics in a way that provides representations of symmetry groups to probe the dynamics of the hadron system. J.M.M.

N73-19693# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
SOME REMARKS ON THE CHARGE FORM FACTOR OF

He4 AND THE CENTER OF MASS MOTION SPURIOUSITY
C. Ciofi, L. Lantto (Oulu Univ., Finland), and P. Toropainen (Oulu Univ., Finland) 2 Sep. 1972 13 p refs In ITALIAN; ENGLISH summary Submitted for publication
(ISS-72/12) Avail: NTIS HC $3.00

It was shown that the various single particle wave functions used to reproduce the charge form factor of He-4 nucleus contain a large amount of center-of-mass motion spuriousity. The good fit to the experimental data obtained with these wave functions is due only to the way the center-of-mass motion coordinate was removed, rather than to the characteristics of the model.
Author

N73-19694# Central Research Inst. for Physics, Budapest (Hungary). Optics Dept.
RESONANCE PHENOMENA IN THE MULTIPHOTON IONIZATION OF EXCITED ATOMS
J. Bakos 1972 23 p refs
(KFKI-72-68) Avail: NTIS HC $3.25

The experimentally measured power, k, in the power function dependence of the multiphoton ionization probability has been found to be higher than the theoretical value of the number of protons, k sub zero, absorbed in the ionization process, contrary to the result k less than k sub zero of previous measurements. The variation of the power in different experimental circumstances is explained by multiphoton resonances with the atomic levels. The general dependence of the multiphoton ionization probability on the light intensity, measured over a wide range, deviates strongly from the power law dependence and can be used to determine the Stark shift of the atomic states involved. Author

N73-19695# Central Research Inst. for Physics, Budapest (Hungary). Optics Dept.
RESONANCE MULTIPHOTON IONIZATION
J. Bakos, A. Kiss, L. Szabo, and M. Tendler 1972 20 p refs Presented at Conf. on Interaction of Electrons with Strong Electromagnetic Field, Balatonfuered, Hungary, 11-16 Sep. 1972
(KFKI-72-69) Avail: NTIS HC $3.00

The five photon ionization of metastable helium atoms was investigated in the case of four photon resonance with atomic levels lying in the energy range close to the ionization limit, where the states are closely packed. The dependence of the five photon ionization yield on the light intensity and frequency was measured. Using the experimental results, the distortion of the atomic structure in light fields of high intensity/i.e. the dependence of atomic term energy on the light intensity/ was determined. Some limitations to the applicability of perturbation theory were revealed. Author

N73-19696# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ON THE SUPPORT PROPERTIES OF THE SCALING FUNCTION FOR TIME-LIKE VIRTUAL PHOTONS
C. Bouchiat, P. Fayet, Ph. Meyer, and N. Sourlas Jul. 1972 14 p refs
(LPTHE-72/28) Avail: NTIS HC $3.00

The support properties of the scaling function in the case of time like virtual photons are studied in a very simple perturbative model. The cancellation mechanisms which insure the identity of the support for time like and space like photons are clearly exhibited. Author

N73-19697*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
DRAG COEFFICIENTS FOR SPHERES IN FREE MOLECULAR FLOW IN O AT SATELLITE VELOCITIES
John W. Boring and Robert R. Humphris Washington NASA Mar. 1973 39 p refs
(Contract NAS1-2538)
(NASA-CR-2233) Avail: NTIS HC $3.00 CSCL 20H

The drag coefficients for the Echo 1 and Explorer 24 spherical surfaces in an O environment were experimentally determined over an energy range of 4 to 200 eV. The experiment was performed by generating a beam of atomic oxygen ions of the proper energy, neutralizing a portion of the beam, and then allowing only the neutral O particles to strike a very sensitive torsion balance. The momentum transferred to the surface was determined from the deflection of the torsion balance. At the lower energies, the more intense ion beam had to be used instead of the neutral beam. The drag coefficients are found to be slightly greater than 2 at energies corresponding to satellite velocities. Author

N73-19698*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRON EMISSION PRODUCED BY PHOTOINTERACTIONS IN A SLAB TARGET
Byron E. Thinger (Calif. State Univ., San Francisco) and James A. Dayton, Jr. Washington Mar. 1973 19 p refs
(NASA-TM-X-2756; E-7265) Avail: NTIS HC $3.00 CSCL 20H

The current density and energy spectrum of escaping electrons generated in a uniform plane slab target which is being irradiated by the gamma flux field of a nuclear reactor are calculated by using experimental gamma energy transfer coefficients, electron range and energy relations, and escape probability computations. The probability of escape and the average path length of escaping electrons are derived for an isotropic distribution of monoenergetic photons. The method of estimating the flux and energy distribution of electrons emerging from the surface is outlined, and a sample calculation is made for a 0.33-cm-thick tungsten target located next to the core of a nuclear reactor. The results are to be used as a guide in electron beam synthesis of reactor experiments.
Author

N73-19699*# Pittsburgh Univ., Pa. Space Research Coordination Center.
MEASUREMENTS OF RECOMBINATION OF ELECTRONS WITH HCO(PLUS) IONS
M. T. Leu, Manfred A. Biondi, and R. Johnsen Mar. 1973 13 p refs Submitted for publication
(Grant NGR-39-011-002)
(NASA-CR-131107; SRCC-185) Avail: NTIS HC $3.00 CSCL 20H

Recombination coefficients of electrons with HCO(+) ions were determined with a microwave afterglow/mass spectrometer apparatus. Afterglow measurements of electron density decays in neon-hydrogen-carbon monoxide mixtures are correlated with the decay of mass-identified ion currents to the wall of the microwave cavity. At the appropriate partial pressures of hydrogen and carbon monoxide in the mixture, the ion HCO(+) dominates the ion composition and its wall current approximately tracks the electron density decay curve. From recombination controlled electron density decay curves, the values alpha (HCO(+)) = (3.3 + or - 0.5) and (2.0 + or - 0.3) 0.0000001 cu cm/sec are obtained at 205 and 300 K, respectively. The implications of these results for models of polyatomic molecule formation in dense interstellar clouds are briefly discussed. Author

N73-19700*# Pittsburgh Univ., Pa. Space Research Coordination Center.
MEASUREMENTS OF RECOMBINATION OF ELECTRONS WITH H3(PLUS) AND H5(PLUS) IONS
M. T. Leu, Manfred A. Biondi, and R. Johnsen Mar. 1973 25 p refs Submitted for publication
(Grant NGR-39-011-002)
(NASA-CR-131108; SRCC-184) Avail: NTIS HC $3.25 CSCL 20H

The electron-ion recombination coefficients for H3(+) and H5(+) ions were determined by means of a microwave afterglow/mass spectrometer apparatus. Measurements of electron density decays in helium-hydrogen mixtures are correlated with the decay of mass-identified ion currents to the wall of the microwave cavity. At low partial pressures of hydrogen in the mixture, the ion H3(+) dominates the ion composition and the ion wall current tracks the electron density decay curves. From recombination controlled electron density decay curves, the values alpha (H3(+)) = (2.9 + or - 0.3), (2.3 + or - 0.3), and (2.0 + or - 0.2) x 0.0000001 cu cm per sec, are obtained at 205, 300 and 450 K, respectively. At higher partial pressures of hydrogen and low temperatures, where (H5(+)) is the dominant ion, the value alpha (H5(+)) = (3.6 + or - 1.0) x 0.0000001 cu cm per sec is obtained at 205 K. The implications of these results concerning ionization levels in the atmospheres of the outer planets and in the interstellar medium are discussed.
Author

N73-19701*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
IONIZATION PROCESSES IN MERCURY DISCHARGES
Frank T. Wu 1 Mar. 1973 37 p refs
(Contract NAS7-100)
(NASA-CR-130924; JPL-TM-33-596) Avail: NTIS HC $4.00 CSCL 20H

A summary of theoretical calculations of the ionization processes in mercury plasma is presented. Various possible ionization processes are analyzed and discussed. It is found that the ionization due to excited state interactions is dominant when the degree of ionization is small and that the ionization due to multistep electron impact is significant when the degree of ionization is high. Author

N73-19702# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
AN ADJOINT GAMMA-RAY MOMENTS COMPUTER CODE, ADJMOM-1 Final Report
George L. Simmons Feb. 1973 21 p refs
(NBS Proj. 2400434; NBS Proj. 2400439)
(NBS-TN-748) Avail: SOD $0.30 domestic postpaid or $0.25 GPO bookstore

Discussion is made of a computer code for generating spatial-angular moments of the adjoint gamma-ray flux in an infinite medium. The equation for the flux moments is given and techniques used for the solution are described. Details of the input data and a sample problem are also supplied. Author

N73-19703*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ULTRAHIGH ENERGY PHOTON SPECTRUM
F. W. Stecker and J. Bredekamp Dec. 1972 10 p refs
(NASA-TM-X-66198; X-641-72-480) Avail: NTIS HC $3.00 CSCL 20H

Results are made of a numerical calculation of the ultrahigh energy photon spectrum. After assuming that the ultrahigh energy cosmic-ray nucleons are universal, calculations are made without resorting to the previously employed delta function approximation. J.M.M.

N73-19704*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-CONSISTENT PAULI CORRECTIONS IN BRUECKNER-HARTREE-FOCK CALCULATIONS
Richard C. Braley and William F. Ford Mar. 1972 12 p refs
(NASA-TM-X-68197; E-7351) Avail: NTIS HC $3.00 CSCL 20H

A scheme is introduced which makes it feasible to make completely self-consistent Brueckner-Hartree-Fock (BHF) and renormalized BHF calculations for spherical, closed-shell and axially-symmetric deformed nuclei. The usual requirement or orbital self-consistency has been imposed, as well as self-consistency in the starting energies and occupation probabilities. Previously, only approximate forms were used for the Pauli operator. This approximation is removed and a method for making the necessary Pauli corrections to the reaction matrix during the approach to self-consistency is presented. A discussion of the symmetries which reduce the problem to one of manageable proportions is included. Author

N73-19705# Oregon Univ., Eugene.
PARTICLE ACCELERATION BY INTENSE COHERENT ELECTROMAGNETIC WAVES
P. L. Csonka 25 May 1972 131 p Sponsored by AEC
(RLO-2041-71) Avail: NTIS

It is suggested that an accelerator can be built in which particles are accelerated by intense bursts of monochromatic electromagnetic radiation of wavelength lambda. Such radiation can be produced by lasers, and is modified by a general optical element called a template. The template is a phase controlled holograph, but often it can be a simple holograph. Accelerating and focusing field elements have dimensions comparable to lambda; a high degree of miniaturization and fields comparable to intraatomic ones result. A laser with 10 to the 14 power Watts instantaneous power and 2.10 sq cm coherence length can accelerate a particle to 180 GeV in 2 meters. Author (NSA)

N73-19706# Battelle-Northwest, Richland, Wash.
HIGH-TEMPERATURE GRAPHITE IRRADIATIONS: 550 TO 1450 C
W. C. Morgan and W. J. Gray 19 Jun. 1972 78 p refs
(Contract AT(45-1)-1830)
(BNWL-1672) Avail: NTIS

Radioinduced physical property and dimensional changes are presented on a wide variety of graphites irradiated at temperatures in the range from 550 to 1450 C and to neutron fluences up to 2.25 times ten to the 22nd n/sq cm. Author (NSA)

N73-19707# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
NUCLEAR RESONANCE INVESTIGATION IN THE SYSTEMS NIOBIUM-HYDROGEN AND NIOBIUM DEUTERIUM Ph.D. Thesis - Tech. Hochschule, Aachen
H. G. Bohn May 1972 69 p refs In GERMAN
(JUL-853-FF) Avail: AEC Depository Libraries

Nuclear resonance measurements were performed on the systems niobium-hydrogen and niobium-deuterium. For niobium-hydrogen, the temperature dependence of the proton relaxation time was measured between 500 and 4 K. Behavior of relaxation is explained through diffusion-dependent dipole-dipole interaction between protons and niobium nuclei, as well as through coupling of protons on conduction electrons. By taking into consideration the electronic contribution to relaxation, the discrepancy between nuclear magnetic resonance and macroscopic diffusion measurements could be eliminated. The nuclear resonance determinations on niobium-deuterium were performed on nearly single-crystalline foils. As a consequence, position of the electric field gradient tensors could be determined with respect to the crystal axis. Results are explainable with either an octahedral or tetrahedral model. NSA

N73-19708# California Univ., Berkeley. Lawrence Berkeley Lab.
LOW ENERGY ELECTRON DIFFRACTION AND AUGER ELECTRON SPECTROSCOPY STUDIES OF THE STRUCTURE OF ABSORBED GASES ON SOLID SURFACES
G. A. Somorjai Jun. 1972 24 p refs Presented at Conf. on Surfaces, Rolla, Mo., 19 Jun. 1972
(Contract W-7405-eng-48)
(LBL-878; Conf-720653-1) Avail: NTIS

Low energy electron diffraction (LEED) studies of the structure of adsorbed molecules on crystal surfaces revealed that ordered surface structures predominate under most conditions of the experiments. For molecules whose size is compatible with the interatomic distance of the substrate, rules of ordering can be proposed that permit prediction of the structure of the adsorbed layer that is likely to form. These rules indicate close packing due to attractive interactions in the adsorbed layer, and that the rotational multiplicity of the substrate is likely to be maintained by the adsorbate structure. When molecules whose dimensions are larger than the substrate interatomic distance are adsorbed, the conditions that control ordering are more complex and simple rules may not be readily applicable. The surface structures of adsorbed gases have also been studied on high Miller Index substrate surfaces. These surfaces are characterized by ordered steps separated by terraces of low index surface orientation. Author

N73-19709# Brookhaven National Lab., Upton, N.Y.
THE rf STACKING IN ISABELLE
E. Keil (CERN) and A. M. Sessler (UCRL, Berkeley) 1972 7 p Sponsored by AEC
(BNL-17274; CRISP-72-74) Avail: NTIS

A modified RF stacking scheme for ISABELLE is proposed. The 12 bunches circulating in the AGS are transferred into ISABELLE by a fast ejection-injection scheme. They are captured in RF buckets and accelerated in energy to a stacking orbit and deposited there with suppressed buckets, by nonadiabatically turning off the RF voltage. The process is repeated about 50 times resulting in 6 x 10 to the 14th power protons stored in an energy spread of about 40 MeV. Subsequently, the coasting stack is bunched and accelerated by a system similar to that presently contemplated for ISA. NSA

N73-19710# Brookhaven National Lab., Upton, N.Y.
WHAT NOT TO DO WITH ISABELLE AND WHY
M. N. Kreisler (Mass. Univ., Amherst) and Y. Y. Lee 30 Oct. 1972 6 p refs Sponsored by AEC
(BNL-17314; CRISP-72-84) Avail: NTIS

The possibilities of muon proton interactions and single beam whiplash to generate monoenergetic neutron beams at ISABELLE are examined. It is concluded that both cases are impractical.
Author (NSA)

N73-19711# Brookhaven National Lab., Upton, N.Y.
MOMENTUM AND TIMING TOLERANCES FOR AGS-ISABELLE SINGLE-BUNCH TRANSFER SCHEME
B. W. Montague (CERN) 28 Sep. 1972 3 p Sponsored by AEC
(BNL-17275) Avail: NTIS

In the proposed bunch-by-bunch transfer from the AGS to ISABELLE three longitudinal type problems can be distinguished including: (1) momentum error of a transferred bunch with respect to the ISABELLE RF bucket; (2) coarse timing of transfer, to inject the AGS bunch into the neighborhood of the correct ISABELLE bucket; and (3) final phasing of transfer, to place the AGS bunch close to the center of the bucket. The tolerances required with respect to these aspects are briefly discussed.
NSA

N73-19712# Brookhaven National Lab., Upton, N.Y.
ISA CLOSED ORBIT DISTORTIONS AND CORRECTIONS
E. A. Crosbie and E. M. Rowe (Wis. Univ.) 30 Aug. 1972 5 p Sponsored by AEC
(BNL-17272; CRISP-72-82) Avail: NTIS

Some comments are presented on monitoring and correction of ISABELLE closed orbit distortions. Author (NSA)

N73-19713# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
MEASUREMENT OF LATTICE DEFECT ENERGY OF DEFORMED COPPER CRYSTAL OF DIFFERING DEGREES OF DEFORMATION AND DIFFERENT ORIENTATION Ph.D. Thesis - Tech. Hochschule, Aachen
H. Steffen May 1972 74 p refs In GERMAN
(JUL-855-FF) Avail: AEC Depository Libraries

An adiabatic twin calorimeter was used for measuring lattice defect energies in differently oriented single copper crystals of high purity. Measured energy loss curves indicated a structural dependence. Observed lattice defect energies depended on the degree of deformation and exhibited a strong orientation dependency. Transl. by G.G.

N73-19714# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
INTERACTION OF COPPER INTERLATTICE ATOMS WITH OTHER POINT DEFECTS IN THE TEMPERATURE RANGE OF 50 TO 207 K Ph.D. Thesis - Tech. Hochschule, Aachen
D. E. Becker May 1972 132 p refs In GERMAN
(JUL-857-FF) Avail: AEC Depository Libraries

Interaction effects between interlattice atoms with holes, dislocations, and interstitial atoms were measured in copper crystals by observing defect production rates as functions of radiation produced defect concentration. Results confirmed that interstitial atoms are absorption centers for three dimensional mobile interlattice atoms and that increased radiation temperatures decrease absorption center concentrations until a saturation effect develops. Transl. by G.G.

N73-19715# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
THERMAL ANNEALING OF RADIATION DAMAGE IN NaCl CRYSTALS STUDIED BY POSITRON ANNIHILATION TECHNIQUES
J. B. Nicholas, C. S. Tumosa, and H. J. Ache 1972 14 p refs Presented at the 20th Ann. Meeting of the radiation Res. Soc., Portland, Ore., 14-18 May 1972 Sponsored by AEC
(Conf-720530-6) Avail: NTIS

The thermal annealing of radiation damage induced by gamma radiation in NaCl crystals was studied by positron annihilation techniques. The results show that the concentration of positron annihilation centers decreases quickly at first upon heating, but then more slowly until a very slowly decreasing region, a pseudo plateau is reached. The A-center concentrations at which these pseudo plateaus are obtained depend on the temperatures at which the annealing processes are carried out. The kinetics of the annealing as observed by the positron annihilation technique is consistent with a bimolecular reaction model. The experimentally obtained activation energy for this process is about 1.2 eV, which suggests the elimination of positive ion vacancies aggregates, which act as positron annihilation centers, by migrating anion vacancies at elevated temperatures. Author (NSA)

N73-19716# Oak Ridge National Lab., Tenn.
COMPUTER PROGRAM FOR THE REDUCTION OF DIFFUSE X-RAY DATA FROM SOLID SOLUTIONS
R. O. Williams Oct. 1972 33 p refs
(Contract W-7405-eng-26)
(ORNL-4828) Avail: NTIS

A computer program to reduce the diffuse X-ray scattering data from cubic alloys by a multiple regression analysis is reported. The solution provides information on the short-range order and the atomic displacements. The advantages of the present method are that it provides increased freedom in making observations, fewer approximations are required, and a complete error analysis is obtained. Author (NSA)

N73-19717# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
VERY BRIGHT FIELD IONIZATION AND FIELD EVAPORATION ION SOURCES. SOME USES. A BEAM FORMATION AND SCANNING SYSTEM
H. Heil and R. Guckenberger Jun. 1972 18 p refs
(IPP-9/6) Avail: AEC Depository Libraries

Field ionization and evaporation ion sources in the form of small wire tips are capable of delivering brightnesses many orders of magnitude larger than conventional sources, with the apparent source size in the 10 A range. Therefore, they serve well as small ion probes for scanning instruments. These instruments, in turn, are unique in their ability to machine very small structures by sputtering, smaller than can be made by other means. Uses are in surface microanalysis, microelectronics, electron and X-ray diffraction, and manipulation and treatment of macromolecules. For focusing, only electrostatic lenses can be used. Computations have shown the aperture lens to be far superior to the usual einzel lens with respect to smallness of focal length and spherical aberration constant. This advantage has to be weighed against the complication of having the target immersed into the electric field. The design of a scanning ion microscope which incorporates such a lens in described. Author (NSA)

N73-19718# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France). Centre d'Etudes.
SIMULATION OF GAMMA RAY EFFECTS ON BIPOLAR TRANSISTORS USING THE CAO PROGRAMS
P. Cottin and G. Hantelle Jul. 1972 29 p refs In FRENCH
(CEA-R-4337) Avail: AEC Depository Libraries

It is demonstrated how the primary and secondary photocurrents of bipolar transistors exposed to pulsed gamma radiation can be calculated using the LINVILL model with the addition of two-dimensional elements of the IBIS model. This idea was developed by the CEA. NSA

N73-19719# Brookhaven National Lab., Upton, N.Y.
HIGH INTENSITY PROTON SOURCES FOR HIGH ENERGY ACCELERATORS
T. Sluyters 1972 20 p refs Presented at 2d Intern. Conf. on Ion. Sources, Vienna, 11 Sep. 1972 Sponsored by AEC
(BNL-17159; Conf-720948-6) Avail: NTIS

A review is presented on the present performance of the ion sources in the world's largest proton linacs and proton synchrotrons installed in the following laboratories: National Accelerator Laboratory (Batavia, USA), Rutherford High Energy Laboratory (Chilton, England), CERN (Geneva, Switzerland), Los Alamos Scientific Laboratory (Los Alamos, USA), Centre d'Etudes Nucleaire (Saclay, France), Institute for High Energy Physics (Serpukhov, USSR), Brookhaven National Laboratory (Upton, USA), and Institute of High Energy Physics (Tsukuba, Japan).
Author (NSA)

N73-19720# Interuniversitair Reactor Instituut, Delft (Netherlands).
QUALITATIVE AND QUANTITATIVE INTERPRETATION OF GAMMA RAY SPECTRA IN ACTIVATION ANALYSIS
P. J. M. Korthoven 1972 13 p refs Presented at 4th Intern. Conf. on Modern Activation Anal., Saclay, France, 2-6 Oct. 1972 (IRI-133-72-09) Avail: NTIS HC $3.00

A method is presented for automatic identification of the elements in a sample and calculation of the corresponding concentrations from the energies and peak areas determined by a spectrum analysis computer program. A preliminary interpretation list is produced in which, for each peak in the spectrum, the possible isotopes are given. This list is based only on the gamma-ray energies and half lives of the isotopes. A careful analysis of this list yields groups of identified elements at four different significant levels. The determination of the corresponding concentrations is based on the single comparator method. The procedure is included in an automatic activation analysis system but can also be used seperately. Author (ESRO)

N73-19721# Interuniversitair Reactor Instituut, Delft (Netherlands).
ACTIVITIES OF THE INTERUNIVERSITAIR REACTOR INSTITUTE Annual Report, 1971-1972 [INTERUNIVERSITAIR REACTOR INSTITUUT JAARVERSLAG 1971-1972]
1972 91 p In DUTCH
Avail: NTIS HC $6.75

The activities at the institute during the period 1971-1972 are reported. They include neutron physics, Mossbauer effect of several metallic compounds, reactor physics, radiochemistry, activation analysis, radiation hygiene, and radiation dosimetry. ESRO

N73-19722# Texas Univ., Austin. Center for Nuclear Studies.
X-RAYS FROM FISSION Annual Report
C. Fred Moore and G. W. Hoffman 31 Dec. 1972 21 p refs (Contract N00014-67-A-0126-0012; ARPA Order 1571) (AD-753542) Avail: NTIS CSCL 20/8

The report is on the activities pursued during the nine months of the contract X-Rays from Fission. During the present contract period a time-of-flight tube has been constructed and tested. All effort is now being devoted to the extraction of isotopic fission yields from the data of energy-time-of-flight-induced L-X-ray coincidence experiments. The test and preliminary data obtained are quite promising. Author (GRA)

N73-19577* Scientific Translation Service, Santa Barbara, Calif.
THE POSSIBILITY OF A UNIQUE DETERMINATION OF THE ELECTRON CONCENTRATION FROM THE RESULTS OF PHASE MEASUREMENTS
V. L. Azarov, V. I. Novozhilov, and G. A. Tavrizov *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 89-98 refs (For availability see N73-19572 10-19)
CSCL 20H

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-19723 Princeton Univ., N.J.
ENERGY DEPOSITION IN PARALLEL-PLATE PLASMA ACCELERATORS Ph.D. Thesis
Marco Sabado DiCapua 1972 180 p
Avail: Univ. Microfilms Order No. 72-24710

To appraise the ratio of energy deposition into kinetic and thermal modes in plasma accelerators, a parallel-plate plasma accelerator was operated in the quasi-steady mode with current pulses in the range of ten to one-hundred kiloamperes, durations of the order of one millisecond. It is found that, for currents between fifty and ninety kiloamperes, the accelerated argon plasma is supersonic with ion velocities of five to six kilometers per second. A momentum and energy balance obtained through a one-dimensional analysis shows that a large fraction (eighty-five per cent) of the input power (ten to twenty megawatts) delivered to the plasma appears in the exhaust flow. However only twenty per cent of the power in the exhaust appears as directed kinetic energy of the flow. The remainder appears as enthalpy of the flow which includes ionization. Dissert. Abstr.

N73-19724 Illinois Inst. of Tech., Chicago.
THE INTERACTION OF ELECTROMAGNETIC WAVES WITH PLASMA Ph.D. Thesis
Jaming Pan 1971 136 p
Avail: Univ. Microfilms Order No. 72-22848

The macroscopic interaction between electromagnetic fields and a lossy, anisotropic, compressible plasma was investigated. The governing equations are the linearized Boltzmann-Vlasov equation, the Maxwell equation, and the equation of continuity. When all these factors are considered, the governing equations are coupled. By separating the longitudinal and transverse components and by rotating the functional space of the longitudinal component, the governing equations are decoupled. The solutions for transformed functions are obtained for a cylindrical symmetry, and then the inverse transformation is applied. After obtaining the solutions for the electric and magnetic fields and for the electroacoustic waves in a real space, the results are used to calculate the scattering of electromagnetic waves by a conducting cylinder with a lossy, anisotropic, compressible plasma sheath. Dissert. Abstr.

N73-19725 New York Univ., N.Y. School of Engineering and Science.
LINEAR AND NONLINEAR IMPULSE RESPONSE FROM A MAGNETOPLASMA COLUMN Ph.D. Thesis
Norman Charles Grody 1972 163 p
Avail: Univ. Microfilms Order No. 72-21762

A study was made of the linear and nonlinear responses of a magnetoplasma resulting from inhomogeneity in the background plasma density. Experiments are performed to measure the plasma response to an impulse electric field and the results are compared to a theory. A 120 picosecond baseband pulse having a maximum peak amplitude of 1860 volts is used to impulsively drive the plasma into the nonlinear regime. The impulse responses obtained from the impulsive excitation are recorded for the different plasma densities, static magnetic fields, and neutral pressures. Also, the frequency spectra of the waveforms are determined by digital Fourier analysis using a Univac 1108 computer. It was found that this nonlinear behavior is accounted for by nonlinear theory of a cold, inhomogeneous plasma. The nonlinear mechanism is attributed to electron bunching and multistreaming resulting from inhomogeneity. Dissert. Abstr.

N73-19726 Saskatchewan Univ., Saskatoon.
NUMERICAL SIMULATION MODELS OF THE PLASMA BETATRON Ph.D. Thesis
Douglas Eilbert Alfred Whitfield 1971 183 p
Avail: Univ. Microfilms Order No. 72-23478

The technique of numerical plasma simulation on a digital computer was used to model some results from the plasma betatron. Except for one largely inconclusive two-dimensional simulation, all of the work was one-dimensional and electrostatic. By making detailed comparisons with experimental measurements, it is possible to indicate some points where the effects included in the model are adequate to explain the real plasma behavior and some where they are not. It was shown that in a one-dimensional plasma with an initial sinusoidal density perturbation the application of a constant external electric field can cause the electrons to split into two groups, one freely accelerating and the other trapped near zero velocity in a potential well resulting from the inhomogeneous ion density. The ensuing electron-electron instability can cause reduced acceleration and heating of the electrons. When an external field is applied, the number of electrons in the trapped group is so small that electron-electron interaction has no significant effect. Dissert. Abstr.

N73-19727*# Illinois Univ., Urbana. Nuclear Engineering Program.
ENERGY DISTRIBUTION OF ELECTRONS IN RADIATION INDUCED-HELIUM PLASMAS Ph.D. Thesis
Ronnie Hung-Kie Lo 1972 133 p refs
(Grants NGR-14-005-183; AT(11-1)-2007)

(NASA-CR-130980) Avail: NTIS HC $8.75 CSCL 20I

Energy distribution of high energy electrons as they slow down and thermalize in a gaseous medium is studied. The energy distribution in the entire energy range from source energies down is studied analytically. A helium medium in which primary electrons are created by the passage of heavy-charged particles from nuclear reactions is emphasized. A radiation-induced plasma is of interest in a variety of applications, such as radiation pumped lasers and gaseous core nuclear reactors. Author

N73-19728# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).

ANALYSIS OF PINCH MECHANISM IN STABILIZED HELICOID BY FEEDBACK [LE MECHANISME DU PINCH HELICODAL STABILISE PAR RETROACTION]

R. Keller Dec. 1972 32 p refs In FRENCH

(LRP-58/72) Avail: NTIS HC $3.75

Methods for analyzing the pinch mechanism in a stabilized helicoid are presented. The mechanism was studied as a function of plasma diameter, wavelength and diameter of the exterior wall, and perfect conduction of the plasma, using the linear equations of motion. Plasma deformation and the force of feedback projected in a restrained helicoid are studied by Fourier analysis. Questions concerning phase transformation and coupling are examined. Transl. by E.H.W.

N73-19729# Sandia Labs., Albuquerque, N.Mex.

INTERACTION OF A RELATIVISTIC ELECTRON BEAM WITH A BOUNDED PLASMA

J. W. Poukey and A. J. Toepfer Sep. 1972 29 p refs Sponsored by AEC

(SC-RR-72-0669) Avail: NTIS

The return current induced in a cylindrically symmetric, uniform, bounded plasma of constant conductivity by the injection of a relativistic electron beam along axis of symmetry is calculated. Cases with and without an applied longitudinal magnetic field are considered. The plasma is assumed to obey a generalized Ohm's law and the effects of beam dynamics are included. Quantitative studies of the effects of the displacement current, the inertial and Hall terms in Ohm's law, finite plasma radius, the existence of end plates in the system, and the finite rise time of the injection beam on the magnitude of the return current are made. Author (NSA)

N73-19730# Los Alamos Scientific Lab., N.Mex.

MULTIPLE PASS LASER HEATING OF A MAGNETICALLY CONFINED PLASMA

Stanley Humphries, Jr. Oct. 1972 5 p refs

(Contract W-7405-eng-36)

(LA-5010) Avail: NTIS

If the plasma to be heated is placed inside the optical cavity of a laser, a multiple-pass system allowing on the order of 100 passes through the plasma can result. Plasma conditions necessary to assure a stable cavity are derived. An experiment is described in which it is expected to significantly raise the temperature of plasma produced in a z-pinch entirely by inverse bremsstrahlung. It may be possible to use the plasma to Q-switch the laser to make more efficient use of the available energy. Author (NSA)

N73-19731# California Univ., Berkeley. Electronics Research Lab.

HEATING OF MAGNETIZED PLASMAS BY A LARGE AMPLITUDE LOW FREQUENCY ELECTRIC FIELD

Liu Chen and C. K. Birdsall Jun. 1972 43 p refs

(Contract AT(04-3)-34)

(UCB-34-P-128-X-2; ERL-M-352) Avail: NTIS

Plasma electron and ion heating due to large amplitude oscillating electric field applied to a steady magnetic field was followed in detail by one dimensional computer simulations. The large oscillating drift velocity at low frequency sets up instabilities due to the periodic electron drift through the ions, which then cause rapid heatings. For waves propagating across the magnetic field, the instability is a Buneman-type upper-hybrid two stream instability. Electron perpendicular thermal velocity is increased with little ion heating. For obliquely propagating waves there is an additional instability, the modified two stream instability. Author (NSA)

N73-19732# Joint Publications Research Service, Washington, D.C.

PENETRATION OF WAVES INTO A PLASMA AT FREQUENCIES CLOSE TO THE LOWER HYBRID FREQUENCY

V. E. Golant Nov. 1972 20 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Leningrad. Fiziko-Tokhn. Inst. report NP-19076 Prepared for AEC

(AEC-tr-7378) Avail: NTIS

The penetration of electromagnetic waves into a magnetized plasma in the region of the lower hybrid resonance, in which their transformation into slow strongly damping plasma waves takes place, is discussed. The conditions of penetration of the waves in uniform and nonuniform magnetic fields are analyzed, and the efficiency of the wave input to the plasma for these conditions is studied. NSA

N73-19733# Joint Publications Research Service, Washington, D.C.

SELF STRESS OF ELECTROMAGNETIC WAVES IN A DENSE COLLISIONLESS PLASMA

G. M. Batanov and V. A. Silin Nov. 1972 9 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Moscow. Fiz. Inst., report NP-19164 Prepared for AEC

(AEC-tr-7374; NP-19164) Avail: NTIS

A study was made of the conditions of the striction and thermal mechanisms of superhigh frequency, self stress in a collisionless plasma. The penetration of a powerful 10 cm electromagnetic wave into a dense plasma is studied experimentally. The maximum electron concentration in the layer of collisionless plasma exceeds the critical concentration by five times. The penetration of the superhigh-frequency waves through the plasma layer was recorded. By means of the Langmuir probe and microwave diagnostic measurements, the ion-sound vibrations were detected in the region close to plasma resonance. The observed effects are explained by the occurrence of a parametric instability of the plasma in the microwave field. Author (NSA)

N73-19734# Joint Publications Research Service, Washington, D.C.

STUDY OF THE AMPLITUDE OF AN ELECTROMAGNETIC WAVE REFLECTED FROM THE BOUNDARY OF AN ANISOTROPIC PLASMA

I. Yu. Adamov, V. L. Berezhnyi, L. A. Dushin, P. M. Lebedev, and V. I. Kononenko Nov. 1972 11 p refs Transl. into ENGLISH from Akad. Nauk Ukrainskoi SSR, Kharkov. Fiziko-Tekhn. Inst. report KHFTI-71-25 Prepared for AEC

(AEC-tr-7368; KHFTI-71-25) Avail: NTIS

The graphical amplitude characteristics of an electromagnetic wave reflected from the boundary of an anisotropic plasma oriented perpendicular to the direction of the magnetic field were obtained as functions of the plasma density, the collision frequency, the magnetic field, and the frequency of signals probing the plasma by computer calculations. These functions can be used in practice to determine the density of anisotropic plasma when measuring the amplitude of a reflected electromagnetic wave. Author (NSA)

N73-19735# Joint Publications Research Service, Washington, D.C.

SOME CHARACTERISTIC FEATURES OF THE FORMATION OF A MICROWAVE DISCHARGE PLASMA IN THE PRESENCE OF MAGNETIC FIELDS GREATER THAN CYCLOTRON

V. I. Arkhipenko, V. N. Budnikov, and A. A. Obukhov Nov. 1972 6 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Leningrad. Fiziko-Tekhn. Inst. report NP-19073 Prepared for AEC

(AEC-tr-7372; NP-19073) Avail: NTIS

A study was made of the discharge formed by microwave power in the presence of magnetic fields larger than the cyclotron field at a specified distance from the absorption boundary. The experimental conditions are as follows: an argon plasma at a pressure of 0.1 to 0.001mm Hg was created in a quartz container 70 cm long and 2.5 cm in diameter placed inside a 10-cm waveguide as a result of absorption of power from a stationary 10-cm source. In the absorption region, lines were detected on transitions through which a discontinuous change in the discharge

parameters took place. The position of these lines is described by the formulas of a one-dimensional wave transformation model in the plasma analogous to those that describe the transformation boundary position. Author (NSA)

N73-19736# Joint Publications Research Service, Washington, D.C.

NONTHERMAL EMISSION OF A MAGNETOACTIVE PLASMA IN THE FIELD OF A SUPERHIGH FREQUENCY PUMPING WAVE

G. M. Batanov and K. A. Sarksyan Nov. 1972 9 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Moscow. Fiz. Inst. report NP-19255 Prepared for AEC
(AEC-tr-7373; NP-19255) Avail: NTIS

An experimental study was made of superhigh frequency emission of a collisionless magnetized plasma on its interaction with a powerful pumping wave in the microwave range. In the emission spectrum on the first harmonic of the pumping wave, red and blue satellites were detected which were shifted with respect to the central peak. Emission was detected on the second harmonic of the pumping wave, the intensity of which increases exponentially with an increase in the power of the incident wave. On interaction of the plasma with the powerful wave with a frequency omega sub o nonlinear intensification of the weak signals with frequencies close to 2 omega sub o was observed. The observed effects of excitation of the satellites and emission on the second harmonic of the pumping wave correlate with the effects of anomalous absorption and heating, and they are explained by parametric excitation of the plasma oscillations. Author (NSA)

N73-19737# Joint Publications Research Service, Washington, D.C.

R-Om EXPERIMENTAL SETUP FOR STUDYING THE INTERACTION OF HIGH-FREQUENCY FIELDS WITH A PLASMA

R. A. Demirkhanov, A. G. Kirov, V. B. Mayburov, A. Z. Rakhelkin, I. S. Savchenko, and M. A. Stotland Nov. 1972 62 p Transl. into ENGLISH from Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Sukhumi. Fiziko-tekhn. Inst. report NP-18801 Prepared for AEC
(AEC-tr-7388; NP-18801) Avail: NTIS

The physical considerations underlying the development of the R-Om setup are presented; its design is described. The quasi-constant and high frequency magnetic fields are calculated, the design of the high frequency system is given, and the parameters of the setup are obtained. Author (NSA)

N73-19738# Joint Publications Research Service, Washington, D.C.

THEORY OF HYDRODYNAMIC STABILITY OF A PLASMA IN THE FIELD OF AN ALFVEN WAVE OF FINITE AMPLITUDE

A. G. Elfimov and F. M. Nekrasov Nov. 1972 20 p refs Transl. into ENGLISH of Russian report NP-19260 Prepared for AEC Washington
(AEC-tr-7384; NP-19260) Avail: NTIS

The stability of a plasma located in the field of a self-consistent Alfven wave was studied. The decay instabilities were investigated for a plasma with Beta much greater than 1. The increments and widths of the instability zones are found. The problem of determining the critical wave amplitude is discussed. The entire solution was found for two types of Alfven waves: standing and traveling. This permitted investigation of the difference between the decay instabilities and the parametric instabilities in a uniform high-frequency field. In the second approximation, the instability associated with dispersion of the Alfven waves was found. The excitation conditions of this instability are less rigid than the excitation conditions of the decay instabilities. Problems connected with buildup of the instabilities of the investigated type in systems bounded along a magnetic field are discussed. Author (NSA)

N73-19739# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

DESCRIPTION AND PROPERTIES OF AN rf PLASMA DESIGNED FOR THE STUDY OF PARAMETRIC INTERACTION OF A STRONG em FIELD WITH PLASMA

M. Muazan 1972 36 p refs
(ITF-72-77-E) Avail: AEC Depository Libraries

The operating properties as well as some technical detail are discussed for an RF resonant plasma (Tonks-Dattner resonances) in which high-intensity RF electric field is produced in this self-sustaining plasma; the electron RF oscillation amplitude is about 20 times larger than the electron Debye length. The experimental setup was designed to study parametric resonance instabilities. The ratio of the average electron plasma frequency to the RF external field frequency can be measured, while simultaneously very pure, noiseless, unstable spectral emissions resulting from the high intensity RF field are observed: noiseless operation comes from a very low electron density random fluctuations rate. The azimuthal configuration of the spectra that are emitted can be determined and it should be possible to localize and study the parametric interaction region in the palsma. Author (NSA)

N73-19740# Joint Publications Research Service, Washington, D.C.

DEVELOPMENT OF THE CONCEPT OF PLASMA TURBULENCE

V. N. Tsytovich Nov. 1972 45 p refs Transl. into ENGLISH from Russian report NP-19167 Prepared for AEC
(AEC-TR-7382; NP-19167) Avail: NTIS

The concept of effective turbulent collisions is of assistance to experiments for clear qualitative interpretation of processes in a turbulent plasma and to theoreticians for clearly distinguishing the turbulent elementary excitations that describe the states close to statistical equilibrium. Author (NSA)

N73-19741# Joint Publications Research Service, Washington, D.C.

MICROWAVE PLASMA HEATING EXPERIMENTS IN TUMAN-2 DEVICE

V. E. Golant, M. G. Kaganskii, L. P. Pakhomov, K. A. Podushnikova, and K. G. Shakhovets AEC Nov. 1972 16 p refs Transl. into ENGLISH of Akad. Nauk. SSSR, Fiz.-Tekhn. Inst., Leningrad, report NP-19160, 1971 24 p
(AEC-tr-7360; NP-19160) Avail: NTIS

The experiments on SHF plasma heating in a toroidal magnetic trap were carried out at frequencies corresponding to the upper hybrid frequency range. In the area of plasma concentration of 10 to the 12th power cm/3 at frequency f = 9 Gc and power P = 80 kW, the efficiency of SHF energy input, which was determined by the changes of the plasma parameters, reached several tens of percent. At concentrations of (1 to 2) x 10 to the 13th power cm/3 and SHF source frequency f = 34 Gc, the energy input efficiency was 5 to 10%. The efficiency difference at various frequencies may be connected with the effect of the evanescence region since the wavelengths were substantially smaller than the chamber dimensions. Author (NSA)

N73-19742# Wright State Univ., Dayton, Ohio.

CHARACTERISTICS OF PLASMA PRODUCED BY THERMIONIC CATHODES WITH RADIAL ELECTRIC FIELDS

John S. Martin and Merrill L. Andrews Nov. 1972 58 p refs (Contract F33615-69-C-1842; AF Proj. 7073)
(AD-754233; ARL-72-0152) Avail: NTIS CSCL 20/9

The report describes a preliminary survey of the steady-state characteristics of four plasma sources developed for a mirror machine experiment. All the sources included thermionic spiral cathodes to produce radial electric fields in the plasma. The sources tested were: (a) radial arc, (b) axial arc, (c) interdigital Lisitano coil with cathode and (d) helical Lisitano coil with cathode. Distributions of electron temperature, ion density, and floating potential, together with local measurements of rms noise level and dominant oscillation frequencies, are presented. Plasma parameters were in the following ranges; electron temperature 10,000 - 80,000 K and ion density 10 to the power of 9 to 10 to the power of 13/cc. Typically the floating potential varied parabolically with radius in the region influenced by the cathode. Author (GRA)

N73-19743# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

ELECTRODYNAMIC MAGNETO PLASMA EXPERIMENT

ELMAX) LOW FREQUENCY INSTABILITIES Interim Report
Kenneth R. Cramer May 1972 32 p refs
(AD-754004; ARL-72-0078) Avail: NTIS CSCL 20/9

The low frequency plasma instabilities of the ARL ELMAX confinement system are analyzed to determine the influence of controllable parameters on their initial growth rates and to estimate the anomalous turbulent plasma losses. Linear and turbulent dispersion relations are derived along with expressions for individual species diffusion coefficients and the ambipolar plasma loss. Results demonstrate that the two stream instability can be avoided whereas the drift instability cannot be controlled by adjusting design parameters. Feedback stabilizing systems are required to function faster than the turbulent electrostatic field auto correlation time if large diffusion losses are to be avoided. Author (GRA)

N73-19744# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
INSTABILITY REGIONS FOR DENSITY-GRADIENT-DRIVEN OSCILLATIONS IN FULLY IONIZED MAGNETOPLASMAS
Walter Friz, Richard Franklin, and Gerhard Mueller Nov. 1972 45 p refs
(AF Proj. 7073)
(AD-754005; ARL-72-0153) Avail: NTIS CSCL 20/9

Results of numerical calculations on the behavior of the low frequency density-gradient-driven drift instability in the collision dominated regime are presented. Real and imaginary parts of the instability frequency are given as a function of the plasma parameters essential for this instability. The calculations are based on a dispersion relation derived from fluid equations applicable to the plasma slab geometry. Author (GRA)

N73-19745# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
DYNAMICS OF A FULLY IONIZED MAGNETOPLASMA
Walter Friz Nov. 1972 34 p refs
(AF Proj. 7073)
(AD-754014; ARL-72-0156) Avail: NTIS CSCL 20/9

The report contains a listing of reports and papers that have evolved from research studies associated with the Q-machine of the Plasma Physics Research Laboratory at ARL and briefly discusses the contents of each listing. A detailed discussion is presented on measuring thermodynamic aspects of low frequency electrostatic waves and nonlinear phenomena in fully ionized plasmas. Author (GRA)

N73-19746# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONSIDERATION OF INELASTIC COLLISIONS IN ELECTRICAL CONDUCTIVITY OF PLASMA
A. Yu. Osherovich and V. S. Engelsht 16 Nov. 1972 13 p refs Transl. into ENGLISH from Prim. Plazmat. v Spektroskopii (USSR), 1970 p 12-16
(Contract AF Proj. 4150)
(AD-753972; FTD-HT-23-1076-72) Avail: NTIS CSCL 20/9

A method is discussed of computing the electrical conductivity of thermal plasma, taking nonelastic collisions into account. Both the effective and the statistically distributed reduction of the ionization energy of an atom in the plasma are taken into consideration. Author (GRA)

N73-19747# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
PLASMA INSTABILITIES Final Report, Jul. 1965 - Apr. 1972
Kenneth R. Cramer Aug. 1972 21 p refs
(AF Proj. 7063)
(AD-754019; ARL-72-0101) Avail: NTIS CSCL 20/9

The report contains a brief description and results of the various research efforts conducted during the period of mid 1965 - April 1972 under an in-house theoretical research program that was supported by a small experimental effort conducted by students from the Air Force Institute of Technology. Also, research contracts with university and industrial scientists supported related efforts. The appendix contains a list of the 55 publications and presentations accomplished under the in-house portion of the program. Author (GRA)

N73-19748# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
PLASMA INTERACTIONS WITH GAS FLOW AND MAGNETIC FIELDS Final Report, Jul. 1965 - Apr. 1972
Kenneth R. Kramer and Herbert O. Schrade Aug. 1972 20 p refs
(AF Proj. 7063)
(AD-754018; ARL-72-0103) Avail: NTIS CSCL 20/9

The report contains a brief description and results of the various research efforts conducted during the period of mid 1965 - April 1972 under an in-house theoretical and experimental research program that was supported by a small experimental effort conducted by students from the Air Force Institute of Technology. Also, research contracts with university and industrial scientists supported related efforts. The appendix contains a list of the publications and presentations accomplished under the in-house portion of the program. Author (GRA)

N73-19749# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARAMETERS OF NONIDEAL CESIUM PLASMA REACHED IN A SHOCK TUBE
B. N. Lomakin, V. E. Fortov, and O. E. Schekotov 16 Nov. 1972 9 p refs Transl. into ENGLISH from Vop. Fiz. Nizkotemp. Plazmy (Minsk), 1970 p 397-399
(AF Proj. 4152)
(AD-754015; FTD-HT-23-1200-72) Avail: NTIS CSCL 20/9

The Debye interaction parameter in the straight and reflected waves were calculated at 50-1000 bar at 400 to 800 degrees and the pressure corrections due to the Coulomb interaction were determined. The high degree of nonideality was limited by the possibility of initial heating of the tube. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-19750 Virginia Univ., Charlottesville.
THEORY OF THE ELEMENTARY EXCITATION SPECTRUM OF SUPERFLUID HELIUM: THE ROTON LIFETIME Ph.D. Thesis
Javier Solana Madariaga 1972 102 p
Avail: Univ. Microfilms Order No. 72-23447

A review of the previous studies of the elementary excitation spectrum of superfluid liquid helium is presented, as well as the results of Raman scattering experiments using liquid helium. In addition, the theory of two roton bound states is developed in accordance with the cumulative theories in the report. Calculation is made also of the roton lifetime and the width of the two roton bound states at zero momentum as observed in the scattering experiments. Dissert. Abstr.

N73-19751 City Univ. of New York.
ELECTROMAGNETIC WAVE INTERACTIONS IN FERROMAGNETIC SEMICONDUCTORS Ph.D. Thesis
Lorenzo Jose Abella 1972 289 p
Avail: Univ. Microfilms Order No. 72-24116

The linear spin wave/helicon wave interactions in p-type ferromagnetic semiconductors are presented in a coupled normal-mode form. To facilitate identification of convective and absolute instabilities, the formulation is done first in spatial domain then in time domain. Using the normal mode amplitudes of the linear case, the spin wave/carrier wave interactions are extended to the nonlinear regime. Coupling coefficients between the various modes supported in the medium are derived, and possible three-frequency distributed parametric interactions are obtained. A special case of parametric excitation is investigated in detail, where the introduction of normal mode amplitudes leads to considerable simplification of the problem. In addition, some recently performed longitudinal magnetoresistance measurements on the p-type ferromagnetic semiconductor Ag(x)Cd(1-x) Cr2Se4, where x = .045, are presented. Additional results with regards to the linear spin wave/carrier wave interactions are also presented. Dissert. Abstr.

N73-19752# Joint Publications Research Service, Arlington, Va.
SELENIDES
V. A. Obolonchik 22 Feb. 1973 20 p refs Transl. into ENGLISH from the book "Selenidy" Izdatel'stvo Metallurgiya, Moscow, 1972 p 117-131, 273-280
(JPRS-58293) Avail: NTIS HC $3.00

Excerpts on selenides of the zinc subgroup metals and on the application of selenides are reported. Author

N73-19753# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE ELECTRICAL STRENGTH OF PRESSED LEAD AZIDE
V. V. Stengach [1972] 6 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (USSR), no. 1, 1972 p 128-132
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results of an experiment to determine the electrical strength of lead azide are presented. The physical factors considered were density, crystal quantity, air pressure, and the electrode surface. Polished steel electrodes with a 1.5 mm round-off radius, between which the spacing varied from 0.05 to 0.5 mm, were used in the experiment to assure an almost homogeneous field in the place of least dielectric thickness. It was found that the electrical strength of pressed lead azide does not remain constant for different spacings between the electrodes, but rather diminishes with an increase in the interelectrode spacing. J.M.M.

N73-19754# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
A COMPUTER PROGRAM FOR THE ANALYSIS OF MASS SPECTRA OF GaTe AND GaSe
A. Martinangeli 26 Jul. 1972 29 p refs In ITALIAN; ENGLISH summary
(ISS-72/11) Avail: NTIS HC $3.50

The experimental apparatus used for the determination of the mass spectra of the layer-type semiconductor compounds GaTe and GaSe is described. A computer program is shown (FORTRAN 4) for the processing of the experimental results with an IBM 7040 computer. Author

N73-19755# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
TEMPERATURE-MODULATED REFLECTIVITY IN THE FUNDAMENTAL EDGE REGION
F. AnfossoSomma, D. Gili-Tos, M. Grandolfo, and P. Vecchia 14 Feb. 1972 32 p refs In ITALIAN; ENGLISH summary
(ISS-72/2) Avail: NTIS HC $3.75

The results are presented obtained by thermally modulating the reflectivity of the layer compounds GaTe in the vicinity of the direct gap region. The experimental results are explained in terms of only a shift of the structure. Author

N73-19756# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
MAGNETIC FIELD DEPENDENCE OF THE MICROWAVE PROPERTIES OF Pb SUPERCONDUCTIVE FILMS, PART 1
E. DiCrescenzo, P. L. Indovina, S. Onori, and A. Rogani 26 Apr. 1972 35 p refs In ITALIAN; ENGLISH summary
(ISS-72/5) Avail: NTIS HC $3.75

Magnetic properties of superconducting films are discussed. The problem studied is the behaviour of critical magnetic fields in thin and thick films and in the situation when the film thickness is of the same order as the microscopic quantities of the superconductor. In addition, the dependence of the temperature on the film thickness is studied. Measurements on a 15.000 A Pb sample showing the information obtained by means of a high sensitivity differential technique working in the microwave range are reported. Author

N73-19757# Central Research Inst. for Physics, Budapest (Hungary). Optics Dept.
PRODUCTION OF FERROMAGNETIC MnBi THIN FILMS BY OPTICAL CONTROL OF VACUUM DEPOSITION AND ANNEALING
A. Lutter and J. Ronaky 1972 10 p refs Submitted for publication
(KFKI-72-70) Avail: NTIS HC $3.00

MnBi samples were produced in a high-vacuum system /1 x 10 to the 8th power torr/ by adopting an optical technique to control layer thickness during deposition and formation of the sample during annealing. With the optimal layer composition, as established by investigations of a series of samples, 500 A thick films with 110 deg/microns Faraday rotation could be obtained. Author

N73-19758# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
ELECTROMAGNETIC RESPONSE OF A SUPERCONDUCTING Pb FILM AS A FUNCTION OF THE MAGNETIC FIELD IN THE MICROWAVE FREQUENCIES, PART 2 [RISPOSTA ELETTROMAGNETICA DI FILM SUPERCONDUTTIVI DI Pb IN FUNZIONE DEL CAMPO MAGNETICO NELLA REGIONE DELLE MICROONDE, PARTE]
E. DiCrescenzo, P. L. Indovina, S. Onori, and A. Rogani 28 Apr. 1972 35 p refs In ITALIAN; ENGLISH summary
(ISS-72/6) Avail: NTIS HC $3.75

A study of the magnetic properties of superconducting films is reported. The results which are in good agreement with the Ginzburg-Landau theory are summarized: (1) dependence of the critical magnetic field H sub cF on the sample thickness, and the determination of a semiemperical expression for each d/lambda(t) ratio; (2) dependence of penetration depth on the magnetic field; (3) study of the order of phase transition as a function of the magnetic field; and (4) determination of the temperature for surface superconductivity. Author

N73-19759# Marquette Univ., Milwaukee, Wis. Coll. of Engineering.
STUDY OF THE DEFECT STRUCTURE OF NONSTOICHIOMETRIC CeO2 Progress Report
R. N. Blumenthal 1972 34 p refs
(Contract AT(11-1)-1441)
(COO-1441-9) Avail: NTIS

Electric conductivity data on CaO-doped CeO2 which involve both ionic and electronic transport has been interpreted in terms of an oxygen vacancy model. Preliminary conductivity measurements on SrO-doped CeO2 indicate that the Po2 dependence of sigma was approximately the same for both CaO and SrO2 doped specimens. However, the mobility of oxygen vacancies appears to be larger in SrO-doped CeO2. The results of the ionic transference measurements on CeO2 doped with 2, 5, and 14 mole percent CaO in the temperature and oxygen pressure ranges 700 to 1000 C and 1 to 10 to the minus 22nd power atm are discussed. Author (NSA)

N73-19760# United Kingdom Atomic Energy Authority, Culham (England).
SHIELDING OF SUPERCONDUCTING MAGNETS IN A FUSION REACTOR
G. M. McCracken and S. Blow Aug. 1972 10 p refs
(CLM-R-120) Avail: AEC Depository Libraries; HMSO 50p; PHI $2.15

The effect of radiation damage on the current density a superconducting composite can carry is discussed, considering damage in the superconductor itself and in the normal conductor used for stabilization and protection. The maximum fast neutron fluence that can be sustained for a 10% reduction in current density was estimated to be approximately 10 to the 18th power nx 1/sq cm for the superconductor and approximately 10 to the 17th power nx 1/sq cm for the normal conductor. Using results from Monte Carlo computations of the neutron flux reduction per unit thickness of shield, the shield thickness required to meet the above criteria is calculated as a function of reactor wall loading, and these results are compared with those calculated on purely thermal criteria. Author (NSA)

N73-19761# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
CERTAIN ASPECTS OF REFRIGERATION USING LIQUID HELIUM
G. Claudet and J. Verdier [1972] 6 p refs In FRENCH; ENGLISH summary Presented at 12th Meeting on Hydraulics, Paris, 6 Jun. 1972
(CEA-CONF-2044; Conf-720648-14) Avail: AEC Depository Libraries

The general operating principles of a thermodynamic cycle extracting heat at 4.2 K are briefly described and it is shown that, whatever cooling method is applied at intermediate temperature, a Joule-Thomson cascade must be used for the final stage. This fact is discussed in detail in order to establish the optimum operating and pre-cooling conditions. Practical design aspects of the cascade are considered; a simple process for separating the phases of the mixture obtained by expansion is described; reference is made of two low temperature radiation equipment cooling installations of this type. NSA

N73-19762# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.

MAGNETIC PROPERTIES OF TYPE 2 SUPERCONDUCTORS WITH SMALL GINZBURG-LANDAU PARAMETER KAPPA

J. Auer May 1972 58 p refs In GERMAN

(JUL-854-FF) Avail: AEC Depository Libraries

Experimentally studied were the transition from type-1 to type-2 superconduction as well as the magnetic behavior of type 2 superconductors near Hc1. Magnetizing measurements were performed at various temperatures and on a large number of samples with Ginzburg-Landau parameters kappa from 0.35 to 1.53 for the system Ta + N and 0.78 to 1.0 for the system Nb + N, respectively. The samples showed an almost ideal reversible behavior and, thus, permitted an exact determination of the desired parameters. The temperature dependence of kappa were consistently higher than theoretical predictions. For pure tantalum, kappa sub zero was extrapolated as 0.355. NSA

N73-19763# Cornell Univ., Ithaca, N.Y.

LOW FREQUENCY DIELECTRIC PROPERTIES OF PARA-ELECTRIC IMPURITIES IN ALKALI HALIDE CRYSTALS AT LOW TEMPERATURE Ph.D. Thesis

T. I. Chang Aug. 1972 91 p refs

(Contract AT(11-1)-3151)

(COO-3151-14) Avail: NTIS

The dielectric susceptibilities of KCl:Li(+), KCl:OH(-), and NaCl:OH(-) systems were measured at 400 Hz to 100 kHz at a temperature range or 0.33 K to 20 K, and RbCl:CN(-) at the same frequency range between 0.03 K and 20 K. A three terminal ac capacitance bridge was used to measure the dielectric susceptibility and loss of the samples. It was found that the low frequency dielectric susceptibility of KCl:Li(+) depends on temperature and electric field in accordance with the (III) tunneling model. The tunneling splitting 0.84/cm and the dipole moment 6.16 Debye obtained from this experiment are in good agreement with those by other techniques. Author

N73-19764# Brookhaven National Lab., Upton, N.Y.

LARGE HELIUM SYSTEMS FOR SUPERCONDUCTING POWER APPLICATIONS AND HIGH ENERGY PHYSICS

J. E. Jensen 1972 17 p refs Presented at Cryogenic Soc. of Am., Helium Div. Sess., Chicago, 3-5 Oct. 1972 Sponsored by AEC and NSF

(BNL-17228; Conf-721023-2) Avail: NTIS

Two areas of applied superconductivity are considered: the transmission of large blocks of electric power and the construction of high-field magnets to be used to extend the energy of particle accelerators. Both of these applications will require helium-temperature refrigerators, as well as rather large quantities of helium in inventory. Examples of several systems for each application are given, with reasons for selection and the advantages and disadvantages. Also included is a discussion of helium refrigerators with the effects of the transport properties of helium on efficiences of such machines in several pressure-temperatures. NSA

N73-19765# Brookhaven National Lab., Upton, N.Y.

THE dc SUPERCONDUCTING BEAM SPLITTING MAGNET SYSTEM

H. Hsieh, R. Britton, R. Gibbs, J. Grisoli, and H. Kapfer 1972 7 p refs Presented at 4th Intern. Conf. on Magnet Technol., Upton, N. Y., 19-22 Sep. 1972 Sponsored by AEC

(BNL-17221; Conf-720908-14) Avail: NTIS

A dc superconducting beam splitting magnet was fabricated and tested at BNL. This component will be used to deflect high intensity protons onto two target stations during the same AGS pulse. The magnet system, the cryostat and the refrigerator are described in detail. Initial fabrication difficulties are presented, and test results are included. Author (NSA)

N73-19766# Argonne National Lab., Ill.

PLASTICITY OF SINGLE CRYSTALS OF NIOBIUM, NIOBIUM-MOLYBDENUM, LEAD, AND LEAD ALLOYS IN THE SUPERCONDUCTING AND NORMAL STATES AT 4.2 K

G. W. Kostorz Jul. 1972 55 p refs

(Contract W-31-109-eng-38)

(ANL-7903) Avail: NTIS

The experimental observations during constant strain rate, creep, and stress-relaxation tests with superimposed reversible reaction, transitions superconducting to normal are reviewed. The current theoretical results for the electronic drag coefficient in normal conductors and superconductors are discussed, and the difficulties in arriving at a complete and unique interpretation of all experimental results are described. Constant strain-rate experiments at 4.2 K with a large number of single crystals of niobium, niobium-molybdenum, lead, and lead-tin, lead-bismuth, lead-thallium, and lead-cadmium are described and discussed. It was implied that the reversible reaction, transition superconducting to normal causes a change in the strength of obstacles, either by the change of electronic drag coefficient or by a change of dielectric screening. In the absence of a low-temperature rate theory for dislocation movement, the suggested interpretations remain unsatisfactory. Author (NSA)

N73-19767# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.

ELASTIC DISPLACEMENT FIELD AND INTERACTION ENERGY OF POINT DEFECTS IN ANISOTROPIC CUBE CRYSTALS

P. H. Dederichs and J. Pollmann Mar. 1972 71 p refs In GERMAN

(JUL-836-FF) Avail: AEC Depository Libraries

Elastic shifting fields of points defects described by triple isotopic dipoles and the interactions between these dipoles, are analyzed. Analog calculations for the shifting field in a weakly anisotropic medium are compared with numerical calculations on copper. Optimal approximation methods are used to analyze the shift behavior of strongly anisotropic media for divergencies from stability limitations. Transl. by G.G.

N73-19768# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

STUDY OF THE GRAIN BOUNDARY OF STAINLESS STEEL BICRYSTALS, BY CREEP TESTS AND BY TRANSMISSION ELECTRON MICROSCOPY OBSERVATIONS Ph.D. Thesis - Univ. Sci. et Medicale, Grenoble

Bernard Michaut Aug. 1972 106 p refs In FRENCH

(CEA-R-4317) Avail: AEC Depository Libraries

Grain boundary structure as related to integranular slipping, plastic deformation, superplasticity, and high temperature deformation was studied in stainless steel bicrystals. Data were collected through creep tests and transmission electron microscopy. Linear point defects are also studied.

Transl. by E.H.W.

N73-19769# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

VERY LOW NOISE AMPLIFIERS FOR SEMICONDUCTOR X-RAY DETECTORS

J. E. Eberhardt 1972 7 p refs Presented at the Electron. Instr. Conf., Hobart, Australia, 17 May 1972

(Conf-720559-2) Avail: AEC Despository Libraries

Semiconductor diodes may be used for the energy-intensity spectral analysis of X-rays which produce pulses of photoionization current in the diode. The technology involved is reviewed and a typical system described. To best match the characteristics of the detector diode, the preamplifier uses a junction field effect transistor (JFET) at its input. The JFET is cooled to 130 K to improve its noise performance. Conventional preamplifiers use commercial JFETs and glass enclosed multi-kilomegohm feedback resistors both of which must be carefully selected for low noise generation. The noisy feedback resistor may be eliminated by the use of the recent techniques of charge pumping or pulsed optical feedback. The JFET dice is removed from its commercial

packaging and remounted on boron nitride, a low loss dielectric for reproducible low noise performance. The preamplifier integrates the input signals and leakage current and when the accumulated charge is about 2 x 10 to the 13th power Coulomb it is removed in 4 microseconds by optical enhancement of the JFET's drain-gate leakage current. Careful mechanical design reduces the microphonic noise. Author (NSA)

N73-19770# Sandia Labs., Albuquerque, N.Mex.
CONSIDERATIONS FOR THE CALCULATION OF SHOCK-INDUCED PHASE TRANSFORMATIONS IN SOLIDS
J. N. Johnson Sep. 1972 51 p refs Sponsored by AEC
(SC-RR-72-0626) Avail: NTIS

The complete equilibrium surface is defined with a minimum of data, and the kinetics of the phase change process are described in terms of physical models of heterogeneous nucleation and growth. For each phase, the equilibrium surface is derived from a thermodynamically consistent, and the locus of points of equal Gibbs free energy between the two phases defines the phase line in the p, T plane. Heterogeneous nucleation of the second phase is considered to take place on dislocations, grain boundaries, grain edges, etc., each of which leads to different mathematical expressions for the time variation of the mass fraction of the second phase. All calculations and expressions are written in forms which can be incorporated, with a minimum of effort, into existing finite difference codes. Author

N73-19771# Brookhaven National Lab., Upton, N.Y.
COIL CONFIGURATIONS IN SUPERCONDUCTING DIPOLES AND QUADRUPOLES
G. Parzen and K. Jellett 1972 8 p refs Presented at 4th Intern. Conf. on Magnetic Technology, Upton, N. Y., 19-22 Sep. 1972 Sponsored by AEC
(BNL-17168; Conf-720908-11) Avail: NTIS

The limitations on the good field apperture of superconducting dipoles, due to approximating the cos theta current distribution using a finite number of ribbon shaped conductors arranged in blocks, are investigated. Results are presented for the good field aperture limit due to the choice of the number of blocks per quadrant. Results are also presented for several ribbon configurations having 5, 6 and 7 blocks per quadrant, for which the lower undesired multipoles are eliminated by using either slight azimuthal displacements of the block or special multipole correction windings. A similar study is also made for quadrupoles having a cos 2 theta current distribution. Results are given for quadrupoles having 2 and 3 blocks per octant. Author (NSA)

N73-19772# Brookhaven National Lab., Upton, N.Y.
MAGNETIZATION EFFECTS IN SUPERCONDUCTING MAGNETS
G. Parzen and K. Jellett 14 Sep. 1972 6 p refs Sponsored by AEC
(BNL-17219) Avail: NTIS

The computed results for field multipoles generated by magnetization effects in superconductors are compared with the measured results for the 14 in. model. Computed results are given for the proposed 3 ft. model. Author (NSA)

N73-19773# Sussex Univ., Brighton (England). School of Mathematical and Physical Sciences.
ELECTRON MICROSCOPY OF DEFECTS IN CRYSTALS Final Report, 1969-1972
J. A. Venables, G. L. Price, and H. M. Kramer Sep. 1972 20 p refs
(Grant EOOAR-69-0051; AF Proj. 9761)
(AD-753108; AFOSR-72-2291TR) Avail: NTIS CSCL 07/4

Reviewed is the authors research on the nucleation, growth and epitaxy of condensed gas crystals. Briefly described are observations of various epitaxial systems, computations of the material parameters needed to understand the nucleation and growth of rare gases on graphite, and the theory of nucleation of thin films. GRA

N73-19774# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
MATERIAL WITH MEMORY
R. S. Rivlin Dec. 1972 33 p refs
(Contract N00014-67-A-0370-0001)
(AD-753460; CAM-100-17) Avail: NTIS CSCL 20/11

The constitutive equations for materials with memory developed by Green and Rivlin are discussed, with particular emphasis on the physical assumptions regarding material behavior which are implied by the mathematical assumptions in the theory. Author (GRA)

N73-19775# Pennsylvania Univ., Philadelphia.
ELECTRONIC SPECTRA AND STRUCTURE OF LARGE MOLECULES AND CRYSTALS Final Report, 1 Jul. 1966 - 30 Jun. 1969
Robin M. Hochstrasser 1972 6 p refs
(Contract DA-ARO(D)-31-124-466)
(AD-753380; AROD-6455-6-C) Avail: NTIS CSCL 07/4

The report summarized research on the following: The study of the electronic spectrum of benzophenone crystals; The study of the low temperature spectra of a number of ketones which showed perturbations in the form of line broadening; and The difference in linewidths for the singlet and triplet states of benzophenone which was used to determine a value of intersystem crossing rate constant. GRA

N73-19776# Pennsylvania Univ., Philadelphia.
ELECTRONIC SPECTRA OF LARGE MOLECULES AND CRYSTALS Final Report, 1 Jul. 1969 - 30 Jun. 1972
Robin M. Hochstrasser 1972 7 p refs
(Contract DA-ARO(D)-31-124-G1115)
(AD-753382; AROD-6455-7-C) Avail: NTIS CSCL 07/4

The report briefly describes work to probe electronic properties of large molecules using low temperature spectroscopic methods and by studying the effects of external fields on high resolution spectra. The measurements of the Stark effect on the benzophenone crystal were completed. A study of the singlet and triplet states of dichlorobenzophenone excitons in electric fields was completed. The dipole moment of the pyridine molecule in its lowest singlet (n pi *) state was determined. A Zeeman effect study of solid carbon disulphide was completed and showed the correctness of assignments based on applications of theory to gas phase spectra. Author (GRA)

N73-19777# Picatinny Arsenal, Dover, N.J.
KINETIC THEORY OF DISLOCATION IN CRYSTAL LATTICE
C. M. Tchen Dec. 1972 73 p refs
(AD-753576; PA-TR-4436) Avail: NTIS CSCL 20/12

The present report develops a kinetic theory of dislocation in crystal lattice in three parts. Part I concerns the analysis of the unsteady distribution of impurity atoms along a dislocation line in a crystal lattice under stress and temperature effects. The kinetic equation in the form of a Fokker-Planck equation is solved, and its solution serves as a basis of calculating the distribution of a particle-pair. A breakaway of an impurity atom from the dislocation line may occur, when the atom is subjected to a stress surpassing a critical value. Therefore, the breakaway process becomes important to the dynamical behavior of a lattice. For this purpose, the mechanism of breakaway is treated statistically in Part II, and the conditional nearest neighbor distribution including the breakaway process is derived. In Part III, statistical treatment is applied to a string model of dislocation, and derives a nonlinear stress-strain relation. The effects of temperature and strain rate are included. GRA

N73-19778# Army Materials and Mechanics Research Center, Watertown, Mass.
PHYSICAL PROPERTIES OF RARE EARTH COBALT MAGNET MATERIALS Technical Report, 1 Jan. - 30 Jun. 1972
David R. Chipman and Laurence D. Jennings, Jr. Sep. 1972 18 p refs
(ARPA Order 1914)
(AD-753572; AMMRC-TR-72-30) Avail: NTIS CSCL 20/12

Studies have been undertaken to define the changes in properties which occur in rare earth-cobalt magnet materials in the temperature range up to 1000 C. A wide range of types of behavior of the time dependence of the magnetization at relatively low temperatures is observed. It is shown that the simple mechanisms for this time dependence do not apply. Unusual types of irreversibility are displayed, and these may be useful in

applications, e.g., in some cases it would be advantageous to remagnetize after a number of hours at the operating temperature. X-ray measurements were carried out at high temperatures. Although some lattice parameter values were determined, it was not possible to gain much structural information because of rapid sample deterioration. Details of the mechanism of this deterioration are reported. Author (GRA)

N73-19779# Northern Illinois Univ., Dekalb. Dept. of Physics.
ELECTRICAL AND OPTICAL PROPERTIES OF AMORPHOUS MATERIALS Semiannual Technical Report
Charles Wood Dec. 1972 75 p refs
(Contract DA-ARO(D)-31-124-72-G115; ARPA Order 1562)
(AD-753903; SATR-5) Avail: NTIS CSCL 20/12

Research on Sb2Se3 is reviewed covering spectroscopic studies of electron states of crystalline and amorphous forms, reflectivity and transmission measurements, photoemission, resistivity vs. temperature studies, preparation and characterization of thin amorphous films, and thermopower and photothermopower measurements. Photoconductivity in antimony oxides is also discussed along with the Mossbauer effect of amorphous semiconductors and glasses. GRA

N73-19780# Rensselaer Polytechnic Inst., Troy, N.Y. Div. of Materials Engineering.
SEMI-CONDUCTION AND ELECTRON HOPPING IN VITREOUS SYSTEMS MICROSTRUCTURE AND MAGNETIC PROPERTIES Final Report
Robert K. MacCrone Dec. 1972 10 p refs
(Contract N00014-67-A-0117-0008; NR Proj. 032-519)
(AD-754104; RPI-404.09-TR-4) Avail: NTIS CSCL 20/12

The work performed during four years is briefly described. It concerned the phase studies of the precipitation of iron oxides in boron oxides. GRA

N73-19781# Office of Naval Research, London (England).
A SHORT SURVEY OF SWISS SUPERCONDUCTING SCIENCE
Edgar A. Edelsack Dec. 1972 11 p refs
(AD-754235; ONRL-R-18-72) Avail: NTIS CSCL 20/12

The report describes research being carried out in superconductivity in the following three Swiss institutions: Institute de Physique Experimental, University of Lausanne; Department de Physique de la Matiere Condensee, University of Geneve; and Eidgenossischen Technischen Hochschule (ETH), Laboratorium fur Festkorperphysik, Zurich. Author (GRA)

N73-19782# Office of Naval Research, London (England).
SECOND EUROPEAN SOLID STATE DEVICE RESEARCH CONFERENCE
Edgar A. Edelsack 5 Dec. 1972 11 p refs Conf. held at Lancaster, England, 12-15 Sep. 1972
(AD-754237; ONRL-C-18-72) Avail: NTIS CSCL 20/12

The Second European Solid State Device Research Conference (ESSDERC) was held at the University of Lancaster from 12 to 15 September 1972. There were 300 attendees representatives of almost every major solid state laboratory in the world (except Russia). This report discusses some of the papers presented at the meeting. Author (GRA)

N73-19783# California Univ., Berkeley. Dept. of Physics.
MILLIMETER AND SUBMILLIMETER WAVE DETECTION AND MIXING WITH SUPERCONDUCTING WEAK LINKS
Paul L. Richards, Franz Auracher, and Theodore Van Duzer Sep. 1972 56 p refs
(Contract N00014-69-A-0200-1056; Grant DA-ARO(D)-31-124-70-G60)
(AD-754083) Avail: NTIS CSCL 20/12

A weak link between two bulk superconductors can exhibit Josephson effects and can be used as a fast, sensitive detector or mixer for electromagnetic radiation. Emphasis in this paper is placed on the millimeter and submillimeter range where such applications are potentially most important, though such devices should also work well at lower frequencies. The peculiar properties of the weak link make possible a variety of modes of operation including one in which it is both local oscillator and mixer. These modes of operation are analyzed and the pivotal experiments are reviewed. Noise and impedance matching are considered and comparison is made with other types of detectors of millimeter and submillimeter waves. Author (GRA)

N73-19784# Cincinnati Univ., Ohio.
HETEROJUNCTION PHOTON DETECTORS Final Report
Janos D. Schanda May 1972 48 p refs Presented at a Joint Phys. and Inst. of Space Sci. Colloq., Cincinnati, 14-15 Feb. 1972
(Contract F33615-70-C-1067; AF Proj. 7885)
(AD-754026; ARL-72-0072) Avail: NTIS CSCL 09/1

The most basic theoretical considerations of the heterojunction photo-effect are explained and a selected review of papers dealing with the photo-effect in heterojunctions and some of their applications is presented. Author (GRA)

N73-19785# Army Electronics Command, Fort Monmouth, N.J.
INTERACTION OF SEMICONDUCTOR MATERIALS WITH LASER RADIATION AT 10.6 MICROMETERS
R. D. Bates, Jr., C. F. Cook, Jr., J. R. Shappirio, R. S. Rohde, and J. P. Mahoney Dec. 1972 42 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-753918; ECOM-4059) Avail: NTIS CSCL 20/12

Initial experiments characterizing the nature and mechanisms of electronic materials failure when irradiated by CW 10.6 micrometer CO2 laser light have been performed. The selective application of such techniques as optical microscopy, scanning electron microscopy, electron microprobe analysis, X-ray crystallography, spin resonance spectroscopy, and infrared spectroscopy provides a specialized dacility for the detailed characterization of the nature of the damage state and the paths which lead to this state. Preliminary results on the changes induced in silicon samples show five distinct phases: (1) thermal etching; (2) stress relief through formation of slip traces and cracks; (3) peak formation; (4) melting; and (5) abrupt surface modification. These detailed results are unique in the study of 10.6 micrometer laser irradiation of semiconductor materials. The nature of these mechanisms and the possible means of component immunization are discussed. Early steps in the development of a theoretical molecular model for the use of a static absorbing gas as a damage prevention mechanism are given. Author (GRA)

N73-19786# Battelle Columbus Labs., Ohio.
INVESTIGATION OF IMPURITIES IN THERMALLY GROWN SiO2 Final Report, 3 Jan. 1972 - 3 Jan. 1973
R. D. Baxter Jan. 1973 77 p refs
(Contract N00019-72-C-0357)
(AD-754110) Avail: NTIS CSCL 20/12

The effects of HCl processing on the quality and electrical stability of thermally grown SiO2 layers on Si were investigated electrically by MOS capacitance measurements and analytically by secondary-ion mass spectrometry (SIMS). The results indicate that the addition of 1 to 10 mole percent of HCl to the oxidizing atmosphere during the thermal oxidation of Si affects both the amount of Na incorporated into the growing oxide and the susceptibility of the oxide to the effects of excess Na introduced during postoxidation processing. The passivation of HCl-processed oxides against positive ion instability appears to occur by two mechanisms. At HCl/O2 ratios approximately = or = < 5 percent, excess Na is trapped or neutralized by Cl incorporated into the oxide, while at HCl/O2 ratios of about 10 percent, the penetration of surface Na into the oxide is impeded by the presence of grown-in Cl. Author (GRA)

N73-19787# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
SPIN ARRANGEMENTS IN DILUTE ALLOYS
B. Window Dec. 1972 12 p refs
(Contract N00014-67-A-0314-0005; NR Proj. 018-304)
(AD-754140; TR-24) Avail: NTIS CSCL 20/12

Mossbauer results for gold iron and copper iron alloys at 300 K and 4.2 K are analyzed to show that the spins in such alloys point in directions determined by the local environment. For clusters of three or more iron atoms linked as near neighbors, the spins point in directions consistent with a large pseudodipolar anisotropic exchange interaction between near neighbors. For pairs of atoms single ion anisotropy appears to dominate the pseudodipolar anisotropy. It is suggested that the unifying feature

of the numerous dilute alloy systems which behave like gold of near neighbors is comparable to or greater than the intercluster or further near neighbor exchange. Author (GRA)

N73-19031 Supertechnology Corp., Boston, Mass.
STABILITY OF A SUPERCONDUCTOR AS INFLUENCED BY THE SUBSTRATE
Ahmed Elbindari *In* AGARD Energetics for Aircraft Auxiliary Power Systems Dec. 1972 11 p refs (For availability see N73-19030 10-03)

N73-19032 Warwick Univ. Coventry (England). Dept. of Engineering.
THE BEHAVIOUR OF COMPOSITE SUPERCONDUCTING MATERIALS UNDER ac CONDITIONS
A. R. Eastham and R. G. Rhodes *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 11 p refs (For availability see N73-19030 10-03)

N73-19033 Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
USE OF SUPERCONDUCTORS FOR PULSED EXPERIMENTS IN PLASMA PHYSICS
A. P. Martinelli *In* AGARD Energetics for Aircraft Auxiliary Power Systems Feb. 1972 7 p refs (For availability see N73-19030 10-03)

N73-19041 Commissariat a l'Energie Atomique, Saclay (France).
ENERGY STORAGE AND DISCHARGE BY SUPERCONDUCTORS [STOCKAGE ET DECHARGE D'ENERGIE AU MOYEN DU SUPRACONDUCTEURS]
P. Genevey, G. Prost, J. Sole, and B. Girard *In* AGARD Energetics for Aircraft Auxiliary Power Systems Jan. 1971 8 p refs In FRENCH (For availability see N73-19030 10-03)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-19788 Texas A&M Univ., College Station.
INDUCED PLASTICIZATION: A SURFACE TREATMENT TECHNIQUE FOR EXTENDING THE ENVIRONMENTAL CAPABILITY OF SOLID PROPELLANT ROCKET MOTORS Ph.D. Thesis
Donald Saylak 1972 130 p
Avail: Univ. Microfilms Order No. 72-24328

A concept is presented for extending the low temperature strain limit of rubber-based solid propellants by means of induced plasticization. The concept is then extended for use as an inner bore treatment for solid propellant rocket motors. The process consists of exposing the cured propellant to a solution of a solvent (Freon-11) and a compatible plasticizing oil. The plasticizer, which alone cannot penetrate into the polymer, is transported by the Freon-11 which acts as a gentle swelling agent. Once the desired penetration depth has been achieved, the lower boiling solvent is removed by vacuum leaving a plasticizer-rich layer capable of withstanding significantly greater strains without cracking. Dissert. Abstr.

N73-19789*# Dow Chemical Co., Walnut Creek, Calif.
STUDY TO OPTIMIZE GELLANT POLYMER-WATER SYSTEMS FOR THE CONTROL OF HYPERGOLIC SPILLS AND FIRES
R. R. Jennings, D. C. MacWilliams, W. C. Foshee, and M. F. Katzer Washington NASA Mar. 1973 204 p refs Film supplement to this report is available from NASA. Ames Res. Center, Moffett Field, Calif. 94035 Attn: Chemical Res. Projects Office, Dr. George M. Fohlen, Mail Stop 223-6
(Contract NAS2-6532)
(NASA-CR-2198) Avail: NTIS HC $3.00 CSCL 21I

A system of buffered gelled water was developed to prevent and control fires from small spills of nitrogen tetroxide-(N2O4)-Aerozine 50-hypergolic fuel. Laboratory studies on various alkalis, buffers, and seavengers for the fuel components are described. Chilling and sodium acetate - acetic acid buffer was found to be the best additives to the gelled water. Field tests and a delivery system (airborne) for the extinguishant are described. A short movie showing the field testing is available upon request.
Author

N73-19790# Explosives Research and Development Establishment, Waltham Abbey (England).
SHOCK INDUCED REACTION IN EXPLOSIVES AND PROPELLANTS
R. Merrifield May 1972 25 p refs
(AD-752372; ERDE-TR-103; BR-29223) Avail: NTIS CSCL 21/9

Two propellants (a cast double-base and an extruded double-base) and two explosives (a 60/40 RDX/TNT mixture - 1% beeswax and nitromethane) were subjected to shocks of known amplitude. The shock producing system used was essentially that of the NOL Standard Gap Test. Threshold pressures for both burning and detonation were obtained. This technique (used originally by Jacobs and Liddiard) has been extended to provide unreacted Hugoniot data. Author (GRA)

N73-19791# Environmental Health Lab., McClellan AFB, Calif.
EFFICIENCY STUDIES ON 1967 AND 1971 ROCKET PROPELLANT CANISTERS Final Report
Philip Diamond Mar. 1972 11 p refs
(AD-752538; EHL-M-72M-6) Avail: NTIS CSCL 06/17

Rocket propellant canisters, Model GMN-SSW, were tested using nitrogen dioxide (NO2) and unsymmetrical dimethyl hydrazine (UDMH). Canisters manufactured in 1967 were compared to canisters made in 1971. Results of the study indicate that there is no statistically significant difference between the absorbing capacities of the new and old canisters for both contaminants. Indicators on the new canisters were unsatisfactory for both UDMH and NO2. Author

N73-19792# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
STUDIES OF SLURRY FUELED PROPULSION SYSTEMS Semiannual Progress Report, 1 Feb. - 31 Jul. 1972
Cecil F. Warner and S. N. B. Murthy Sep. 1972 47 p refs
(Contract N00014-67-A-0226-0013)
(AD-754117; TM-72-5; SAPR-5) Avail: NTIS CSCL 21/4

The development of an analytical model for the ignition and combustion of aluminum particles in a hydrocarbon carrier is presented together with the predicted length of cylindrical combustor required for the complete combustion of selected slurry fuels containing aluminum powders. The results of the experimental investigation of the combustion efficiencies of selected fuels, JP-4, JP-5, decalin, 70% tetralin-30% decalin, and 75% aluminum-25% decalin, burned in a sudden dump combustor are presented and discussed. Descriptions of two experimental combustor configurations and one flow visualization model combustor are given. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-19793* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE ENGINE FUEL CONTROL Patent
Harold Gold, inventor (to NASA) Issued 30 Jan. 1973 12 p Filed 28 May 1971 Supersedes N72-10824 (10 - 01, p 0121)
(NASA-Case-LEW-11187-1; US-Patent-3,713,290; US-Patent-Appl-SN-147922; US-Patent-Class-60-39.28R) Avail: US Patent Office CSCL 21E

A variable orifice system is described that is responsive to compressor inlet pressure and temperature, compressor discharge pressure and rotational speed of a gas-turbine engine. It is incorporated into a hydraulic circuit that includes a zero

gradient pump driven at a speed proportional to the speed of the engine. The resulting system provides control of fuel rate for starting, steady running, acceleration and deceleration under varying altitudes and flight speeds.
Official Gazette of the U.S. Patent Office

N73-19794# Advisory Group for Aerospace Research and Development, Paris (France).
BOUNDARY LAYER EFFECTS IN TURBOMACHINES
J. Surugue, ed. (ONERA, Chatillon-sous-Bagneux, France) Dec. 1972 473 p refs In ENGLISH; partly in FRENCH (AGARD-AG-164; AGARDograph-164) Avail: NTIS HC $25.75

Studies dealing with the role of boundary layers in turbomachine design and operation are reported. The areas of investigation include subsonic, supersonic, and transonic flow machines. For individual titles, see N73-19795 through N73-19818.

N73-19795 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ON THE TWO DIMENSIONAL BOUNDARY LAYERS AS THEY APPEAR ON TURBOMACHINE BLADES
K. D. Papailiou, A. Satta (Cagliari Univ.), and F. Nurzia (Genova Univ.) *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 1-27 refs (For availability see N73-19794 10-28)

Universal curves were developed which relate general properties of optimized boundary layers suitable for the critical side of a blade, to overall design variables. The problem of maximum deceleration was considered and universal curves were developed which establish the deceleration which can be realized giving a length and the initial conditions for the boundary layer. These universal curves were established for incompressible flow. Using Le Foll's method, with the introduction of a typical Mach number as an additional parameter, it should be possible to extend the universal design curves to compressible flow. The effects of curvature on turbulence are discussed and it is shown that Bradshaw's model could be used not only for differential but also for integral methods. Author

N73-19796 United Aircraft Corp., East Hartford, Conn. Research Labs.
PRACTICAL CALCULATIONS OF TRANSITIONAL BOUNDARY LAYERS c12
H. McDonald and R. W. Fish *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 29-53 refs (For availability see N73-19794 10-28)

A general finite-difference procedure for computing the behavior of compressible two-dimensional boundary layers is presented together with a turbulence model which allows quantitative predictions of the location and extent of the transition region between laminar and turbulent flow as it is influenced by such disturbances as surface roughness and free-stream turbulence. Reverse transition, i.e., relaminarization, caused by large favorable streamwise accelerations, is also quantitatively predicted by this procedure. The solution procedure depends upon the calculation of the streamwise development of a turbulent mixing length whose magnitude is governed by the turbulence kinetic energy equation. A large number of comparisons between predictions and measurements were made and in general very good agreement was obtained. Author

N73-19797 National Gas Turbine Establishment, Pyestock (England).
PREDICTIONS OF BOUNDARY LAYER TRANSITION ON TURBOMACHINERY BLADES c12
J. Dunham *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 55-71 refs (For availability see N73-19794 10-28)

Transition may occur either in the form of natural transition or as a laminar separation bubble ending in reattachment as a turbulent boundary layer. Existing theories of both types are applied to predicting the available transition observations on turbomachinery blading. Owing to the high free stream turbulence level in a turbomachine, many blades must exhibit natural transition, but too few experimental measurements are available to test the predictions adequately. More experiments were conducted involving bubble transition, and after modifying the theory to allow for free stream turbulence, predictions agree fairly well with measurements of the position and length of transition bubbles. Author

N73-19798 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
INFLUENCE OF THE DEGREE OF TURBULENCE ON THE AERODYNAMIC COEFFICIENTS OF CASCADES c12
R. Kiock *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 73-88 refs (For availability see N73-19794 10-28)

An inviscid degree of turbulence is calculated from the circumferential distribution of the potential flow velocity behind a rotating cascade. This is compared with measurements of the degree of turbulence at a stator inlet of a multi-stage axial compressor. Extensive measurements on the influence of the turbulence level on the aerodynamic coefficients of several two-dimensional compressor cascades were carried out. These contained wake traverses, boundary layer measurements and pressure distribution on the profiles. These investigations were carried out in incompressible flow in the range of Reynolds numbers between 90,000and 270,000 both in a low speed and a high speed cascade wind tunnel. Author

N73-19799 Detroit Diesel Allison, Indianapolis, Ind.
THE EFFECT OF FREE STREAM TURBULENCE LEVEL ON TURBULENT BOUNDARY LAYER BEHAVIOUR c12
G. David Huffman, D. R. Zimmerman, and W. A. Bennett *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 89-115 refs (For availability see N73-19794 10-28)

The results of an experiment to determine the effect of free-stream turbulence level on the classic boundary layer properties indicate the following: (1) The boundary layer thickness increases with increasing turbulence level. This was considered as being due to the increased entrainment brought about by the highly excited state of the boundary between the shear layer and the free-stream. (2) The mean velocity remains largely unchanged in the inner region; however, there is a marked reduction in the wake component as the free-stream turbulence level increases. (3) The skin friction increases with increases in the turbulence level. (4) The shape factor decreases slightly with increased turbulence level due to the reduced wake component. D.L.G.

N73-19800 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
ANALYTICAL APPROACH FOR THE LOSS AND DEFLECTION BEHAVIOUR OF CASCADES IN TRANSONIC FLOW INCLUDING AXIAL MASS FLOW VARIATION c12
Leonhard Fottner *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 119-139 refs (For availability see N73-19794 10-28)

The method described contains a calculation of the viscous transonic flow past cascades of slender, slightly cambered profiles, and includes the local supersonic field, the terminal compression shock and a variation of the axial mass flow density across the cascade. The influence of a change in axial velocity across the cascade is considered by introducing additional strips of sources and sinks into the singularity method. Thus, there are induced velocities on the profile surface which have to be added to the surface velocities of the plane case. The local supersonic field which builds up downstream of the sonic point is treated by an empirically corrected supersonic expansion. The location strength of the compression shock terminating the supersonic field downstream is obtained by an empirically corrected normal shock relation. The viscous effect is determined by means of a boundary layer calculation along the profile contour. The problem of interaction between the boundary layer and the normal shock, which is particularly important in the consideration of viscous effects, is closely investigated with the aid of the available test data. The entire flow loss is determined from the shock losses and the profile losses. The latter are obtained from the boundary layer values at the trailing edge, with consideration of possible small separation areas and the mixing losses produced in the wake. Author

N73-19801 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

BLADE OPTIMIZATION BASED ON BOUNDARY LAYER CONCEPTS

Shuang Huo *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 141-170 refs (For availability see N73-19794 10-28)

An optimization method based on Le Foll's theory is described. This is an inverse problem where one specifies the optimum boundary layer and obtains the velocity distribution. By using potential methods the corresponding profile or channel shape may be obtained. The calibration procedures for the incompressible and compressible boundary layers are shown. Some examples of the application of the method are given and the work still to be done in the compressible case is discussed. Author

N73-19802 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.

INCOMPRESSIBLE FLOW THROUGH CASCADES WITH SEPARATION c12

W. Geller *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 171-186 refs (For availability see N73-19794 10-28)

A singularity method is given for calculating the flow in a cascade with constant blade-surface pressure distribution in the complete region between separation points on the upper and lower surfaces. The contours of blades are replaced by vortex sheets. Source distributions on the contours in the region of separation are used for simulating displacement effects of the separated wake. The position of separation points must be estimated before starting the calculation. Their actual position is found by boundary-layer computation. As shown by comparison of theoretical and experimental results, calculated pressure distributions and flow deflection angles generally agree well with measured data, while the corresponding drag coefficients agree satisfactorily. Author

N73-19803 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

INFLUENCE OF ANGLE OF ATTACK AND DEFLECTION ON BOUNDARY LAYER FLOW IN UPRIGHT CASCADE BLADES [INFLUENCE DE L'ANGLE D'ATTAQUE ET DE LA DEFLEXION SUR LE DECOLLEMENT DE LA COUCHE LIMITE DANS UNE GRILLE D'AUBES DE REDRESSEUR] c12

Jacques Paulon *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 187-201 refs In FRENCH (For availability see N73-19794 10-28)

Cascade blade performance, as affected by boundary layer flow incidence and strong deflection, is examined. Trailing edge flow, backflow, and static pressure degradation are analyzed in detail. Transl. by E.H.W.

N73-19804 Technische Universitaet, Brunswick (West Germany). Inst. fuer Stroemungsmechanik.

THE EFFECT OF AXIAL VELOCITY RATIO ON THE AERODYNAMIC COEFFICIENTS OF A COMPRESSOR CASCADE IN VISCOUS FLOW c12

U. Stark *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 205-220 refs (For availability see N73-19794 10-28)

Both theoretical and experimental investigations of the effect of axial velocity ratio on the aerodynamic coefficients of two compressor cascades with NACA 65-(10)06 profiles are described. For the potential flow calculations the Pollard-Horlock method was selected. Boundary-layer calculations were performed based on the potential flow velocity distributions. The aerodynamic coefficients were calculated from the boundary-layer parameters at the blade trailing edge. The experimental investigations were carried out in a low-speed cascade tunnel. Both the theoretical and experimental results show a considerable effect of the axial velocity ratio on the aerodynamic performance of compressor cascades. The agreement between theory and experiment is quite satisfactory in as far as no severe flow separation occurs. Author

N73-19805 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).

THE INFLUENCE OF AXIAL VELOCITY DENSITY RATIO ON COMPRESSOR CASCADE PERFORMANCE IN COMPRESSIBLE FLOW c12

W. Heilmann *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 221-240 refs (For availability see N73-19794 10-28)

Results of theoretical and experimental investigations on the influence of the ratio between the axial velocity density upstream and that downstream on the performance of plane compressor cascades in compressible flow are presented. Tests were performed in a 7-inch transonic wind tunnel where upstream turbulence levels were varied. It could be demonstrated that the change in cascade performance with the axial velocity density ratio substantially depends upon the blade boundary layer behaviour. At fully turbulent boundary layers the axial velocity density ratio influences only the separation point positions. At laminar-turbulent boundary layers in addition the transition point position from which the separation point positions depend will be influenced. Boundary layer calculations conducted in the theoretical part of the investigation have qualitatively confirmed the experimentally achieved results as far as the influence of the axial velocity density ratio on the transition and separation point position is concerned. Total pressure loss at various axial velocity density ratios was calculated by applying an approximative method of determining the characteristic boundary layer values in separated flow and then comparing with the test results. Author

N73-19806 Rolls-Royce, Ltd., Bristol (England).

THE ROLE OF BOUNDARY LAYERS IN AXIAL FLOW TURBOMACHINES AND THE PREDICTION OF THEIR EFFECTS c12

N. J. Seyb *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 241-259 refs (For availability see N73-19794 10-28)

The prediction of boundary layer conditions within a turbomachine is reviewed from the engine designer's viewpoint. A brief outline of the problems and compromises forced on the aerodynamicist is given followed by a discussion of the boundary layer prediction methods currently in use. Because of the extremely complicated flow patterns present in a turbomachine only the simplest cases (i.e. flow in two-dimensional cascades) have responded adequately to theoretical treatment. Simple and practical methods are described for the prediction of the boundary layer parameters, transition and laminar separation points, bubble sizes and heat transfer coefficients, etc. for any cascade, incidence, Reynolds number, turbulence level, etc. Comparisons between experiment and prediction are given and it is shown that there is good agreement. Author

N73-19807 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).

A CALCULATION METHOD FOR THE EXTERNAL HEAT TRANSFER TO TURBINE BLADES c33

D. K. Hennecke *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 261-273 refs (For availability see N73-19794 10-28)

A complex calculation method was devised to predict the local temperature distribution in a cooled turbine blade. The report is devoted exclusively to one of the key elements of the procedure which is an integral type boundary layer analysis to predict the distribution of the external heat transfer coefficient. The analysis has been adapted to the special requirements of turbine blade cooling research. Thus, it accounts for the combined effects of compressibility, laminar as well as turbulent flow regions, favorable and adverse pressure gradients, smooth and/or rough blade surfaces, lateral convergence or divergence, and temperature dependent fluid properties. Furthermore, in the evaluation of the heat transfer coefficient, a pressure gradient in flow direction and a longitudinal temperature gradient within the wall are considered. The method also allows injection into the boundary layer, either local (film cooling) or continuous (effusion cooling). Results are presented graphically for a cooled turbine blade with a certain profile and specified flow conditions. For this example, the various features, listed above, were studied individually and the magnitude of their effects on the heat transfer coefficient is demonstrated. Author

N73-19808 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
METHOD OF CALCULATING THREE DIMENSIONAL TURBULENT BOUNDARY LAYER SEPARATION WITH APPLICATION TO A SIMPLE TURBOMACHINE CASE [METHODE DE CALCUL DE LA COUCHE LIMITE TURBOULENTE TRIDIMENSIONNELLE JUSQU'A LA SEPARATION APPLICATION A UN CAS SIMPLE DE TURBOMACHINE] c12
R. Michel *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 277-292 refs In FRENCH; ENGLISH summary (For availability see N73-19794 10-28)

The proposed method is based on the determination of similarity solutions for three-dimensional turbulent boundary layers; solutions established from an improved mixing length model. The characteristics of the families of streamwise and crosswise velocity profiles obtained in this way are then used in a method for solving boundary layer global equations. Applied and tested previously for aeronautics problems, the technique is extended to treat turbomachinery problems, taking into account, among other things, the effects of rotation walls. The case of the swirling flow in the diffuser of a centrifuge compressor is examined, and the position of separation, i.e. the circle on which the wall streamlines accumulate, is determined as a function of the inlet angle. It is also found that a rotation at the diffuser walls entails a much slower thickening of the boundary layers, and a noticeable recession of separation. Author

N73-19809 Institute TNO for Mechanical Constructions, Delft (Netherlands).
MEASURED AND CALCULATED TURBULENT BOUNDARY LAYER FLOW IN A VANELESS RADIAL DIFFUSER c12
C. B. V. D. Voorde and J. Bos *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 293-310 refs (For availability see N73-19794 10-28)

A method is presented for predicting two-dimensional flow through a radial diffuser with flat parallel walls. The method is based on the integral entrainment method and is valid until the flow is fully developed. Equations are given for: prediction of the velocity distribution across the diffuser width at any arbitrary station, prediction of the radial distribution of the static pressure recovery, and calculation of the diffuser efficiency from the predicted and measured flow. An experiment conducted for validation of the prediction method is described. During the experiment very accurate measurements were made of the velocity distribution across the constant diffuser width at various stations along a diffuser radius. The experimental values concurred well with predicted values. D.L.G.

N73-19810 Technische Hochschule, Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
APPLICATION OF BOUNDARY LAYER FENCES IN TURBOMACHINERY c12
H. Pruemper *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 311-331 (For availability see N73-19794 10-28)

The major secondary flows occurring in turbine stages are presented and their causes and their effect on the total flow are discussed. Through visualization of the flow lines near the wall and accurate measurement of the three-dimensional loss distribution of cascades with short and longer blades, detailed information may be obtained on the mechanism of the secondary flows and the secondary losses thereby produced. In the course of experimental tests aimed at possibilities of suppressing secondary flows and secondary losses incidental thereto, the method of using boundary layer fences on the profile suction sides of the blades proved to be particularly effective and economical. Finally, the experimental results obtained from the application of this method in a turbine stage are presented. Author

N73-19811 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SECONDARY FLOW RESEARCH AT THE VON KARMAN INSTITUTE c12
J. W. Salvage *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 333-361 refs (For availability see N73-19794 10-28)

Experimental work in cascade secondary flows accomplished in the past ten years is reviewed with the objective of pointing out difficulties common to the field. Investigations included tip clearance effects, low aspect ratio effects, and the beginnings of basic research on the influence of blade loading and inlet boundary layer characteristics on common compressor blade profiles. The objective of current investigations is to select critical configurations for in-depth study of the end-wall boundary layer development through the cascade with a view toward refining the experiment for use in the truly three-dimensional environment of a stator row. An initial experiment on end-wall flows is outlined and typical data shown. An improved technique is discussed, including test apparatus and probes to be used. Other topics discussed include an interesting method of reducing secondary flow losses (partial blade slotting) and the critical analysis of a simple, but geometrically limited, theory predicting secondary flow losses at high blade loading conditions. Author

N73-19812 Princeton Univ., N.J.
THE PREDICTION OF AXIAL COMPRESSOR PERFORMANCE WITH EMPHASIS ON THE EFFECT OF ANNULUS WALL BOUNDARY LAYERS
G. L. Mellor and T. F. Balsa *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 363-374 refs (For availability see N73-19794 10-28)

Current results are summarized in the development of a computer program to simulate axial compressor performance. The program incorporates a new theory of annulus wall boundary layers which predicts annulus boundary-layer development and losses. Aside from the work involved with the construction of the program, considerable effort is being expended to diagnose existing multistage data in terms of the rather simple parameters associated with the annulus boundary-layer theory. Author

N73-19813 Cambridge Univ. (England).
PREDICTION OF ANNULUS WALL BOUNDARY LAYERS IN AXIAL FLOW TURBOMACHINES c12
M. Daneshyar, J. H. Horlock, and H. Marsh *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 375-392 refs (For availability see N73-19794 10-28)

Various existing integral boundary layer methods have been examined and their predictions are compared with a wide range of experimental data. The sensitivity of the boundary layer calculations to the mainstream data input has been examined. Author

N73-19814 Technische Hochschule, Aachen (West Germany).
ANNULUS WALL BOUNDARY LAYERS IN AXIAL FLOW TURBOMACHINES c12
W. Bitterlich and K. Rubner *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 393-413 refs (For availability see N73-19794 10-28)

The influence of annulus wall boundary layers, which differ considerably from ordinary boundary layers, is shown as it affects the entire flow in turbomachines. Starting from the measured velocity distributions, the radial balance in the axial gaps and in the cascade channel of the rotor and stator is established by means of the conservation equations for mass, momentum and energy. The special effects of the transitions between stationary and moving cascades within the region of the annulus wall boundary layers are illustrated. The velocity distributions measured in the boundary layer region are thus explained. In contrast to what had been generally assumed, strong gradients of total enthalpy occur within the boundary layer. For the blade momentum, boundary values at the annulus walls and at the mean radius can be indicated, so that a qualitative distribution of blade momentum may be established. The theoretical statements and results have been confirmed by experimental investigations on a single-stage axial-flow compressor having a very small hub-tip ratio. Theory and experiment show clearly that the influence of wall friction is not confined to the boundary layer region but, even with a small hub-tip ratio, affects the entire flow channel. Author

N73-19815 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RESULTS OF INTERACTION OF SHOCK WAVE WITH TURBULENT BOUNDARY LAYERS AT MODERATE MACH SUPERSONIC NUMBERS [RESULTATS SUR L'INTERAC-

TION CHOC-COUCHE LIMITE TURBULENTE A DES NOMBRES DE MACH MODEREMENT SUPERSONIQUES] c12

J. Delery and J. C. LeBalleur *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 419-440 refs In FRENCH; ENGLISH summary (For availability see N73-19794 10-28)

Reflection of an oblique shock wave on a turbulent boundary layer was studied experimentally on a two-dimensional plane set-up at two Mach numbers, 1.62 and 1.92. In both cases the upstream flow was uniform and the Reynolds number was around 100,000. The variable parameter was the shock intensity. Particular attention was paid to the set-up design for minimizing the perturbation effects and also for obtaining a good measuring precision, especially for boundary layer probings. Author

N73-19816 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

SHOCK WAVE BOUNDARY LAYER INTERACTION IN CASCADES c12

H. Griepentrog *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 441-456 refs (For availability see N73-19794 10-28)

Experimental data obtained with compressor cascades were analyzed to determine the main parameters that affect the shock boundary layer interaction region. These parameters were found to include: (1) the displacement thickness of the boundary layer upstream of the shock, (2) the shock intensity, and (3) the pressure gradient downstream of the shock. Taking these parameters into account, a simple model of the interaction was designed. The model only considers the external effects, such as pressure distribution on the blade surface. The model presented is considered only a tentative one and further research is indicated to understand the interaction of a quasi-normal shock with a turbulent boundary layer in compressor cascades. D.L.G.

N73-19817 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

BEHAVIOR OF BOUNDARY LAYER IN SUPERSONIC STRAIGHT AND ANNULAR BLADE CASCADES, FIXED AND MOBILE [COMPORTEMENT DE LA COUCHE LIMITE SUR GRILLE D'AUBES SUPERSONIQUES PLANES ET ANNULAIRES]

Jean Fabri and Roland Sovrano *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 457-468 refs In FRENCH; ENGLISH summary (For availability see N73-19794 10-28)

Fundamental research on supersonic axial flow compressors requires an accurate knowledge of section performances. Straight and annular supersonic blade cascades were used for the investigation, the latter one being either fixed or rotating. The effect of boundary layer development in these blade cascades is described. Schlieren pictures of the flow field and shock configuration as well as pressure distributions on the blades (straight and fixed annular cascades) or on the casing (fixed and rotating annular cascades) were taken. The conclusion from the analysis is that at low backpressure, i.e. started supersonic flow in the cascades, flow configuration and pressure distributions are very similar on all three experimental set-ups. However, at high back pressure, with strong shock waves induced in the blade channel, shock wave-boundary layer interaction is quite different in static and rotating cascades. It seems however that owing to the effect of centrifugal forces induced by flow rotation in the annular cascade, the difference between flow patterns in this type of experimental set-up and on rotors is not very great. Author

N73-19818 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

HIGH SPEED SCHLIEREN FILM OF THE PULSATING FLOW IN A TRANSONIC TURBINE CASCADE c14

O. Lawaczeck *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 469-473 refs (For availability see N73-19794 10-28)

A high speed schlieren film is discussed that was taken in a cascade wind tunnel on a supercritical flow through a special type of a turbine cascade. The flow pattern near the leading edges shows that the upstream flow is stationary although nonstationary effects were noted near the trailing edge. The question is posed as to whether the nonstationary effects are initiated by the disturbances originated by the free jet boundary of the cascade or by the interaction between the trailing edge shock and the wake of the blade. D.L.G.

N73-19819*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CASCADE PLUG NOZZLE Patent Application

Blake W. Corson, Jr., inventor (to NASA) Filed 13 Feb. 1973 21 p

(NASA-Case-LAR-10951-1; US-Patent-Appl-SN-331759) Avail: NTIS HC $3.25 CSCL 21E

An exhaust nozzle for a jet aircraft providing jet noise suppression is described. The nozzle includes a number of coaxial airfoil ring segments which are spaced serially along the longitudinal axis of the nozzle to define annular coaxial channels. The diameters of the segments progressively decrease downstream along this axis. The radial depths of the channels are small compared with the axial distance between adjacent noncoplanar channel exits, so noise is emitted nonsimultaneously from the channel exits as a series of weakened pulses staggered in time. The boattail angles of the outer surfaces of the ring airfoil segments increase in magnitude with increasing distance downstream to reduce drag. Author

N73-19820*# American Airlines, Inc., New York.

AN AIRLINE STUDY OF ADVANCED TECHNOLOGY REQUIREMENTS FOR ADVANCED HIGH SPEED COMMERCIAL TRANSPORT ENGINES. 1: ENGINE DESIGN STUDY ASSESSMENT

G. Phillip Sallee Mar. 1973 110 p 3 Vol.

(Contract NAS3-15572)

(NASA-CR-121132) Avail: NTIS HC $7.50 CSCL 21E

The advanced technology requirements for an advanced high speed commercial transport engine are presented. The results of the phase 1 study effort cover the following areas: (1) statement of an airline's major objectives for future transport engines, (2) airline's method of evaluating engine proposals, (3) description of an optimum engine for a long range subsonic commercial transport including installation and critical design features, (4) discussion of engine performance problems and experience with performance degradation, (5) trends in engine and pod prices with increasing technology and objectives for the future, (6) discussion of the research objectives for composites, reversers, advanced components, engine control systems, and devices to reduce the impact of engine stall, and (7) discussion of the airline objectives for noise and pollution reduction. Author

N73-19821*# American Airlines, Inc., New York.

AN AIRLINE STUDY OF ADVANCED TECHNOLOGY REQUIREMENTS FOR ADVANCED HIGH SPEED COMMERCIAL TRANSPORT ENGINES. 2: ENGINE PRELIMINARY DESIGN ASSESSMENT

G. Phillip Sallee Mar. 1973 78 p 3 Vol.

(Contract NAS3-15572)

(NASA-CR-121133) Avail: NTIS HC $6.00 CSCL 21E

The advanced technology requirements for an advanced high speed commercial transport engine are presented. The results of the phase 2 study effort cover the following areas: (1) general review of preliminary engine designs suggested for a future aircraft, (2) presentation of a long range view of airline propulsion system objectives and the research programs in noise, pollution, and design which must be undertaken to achieve the goals presented, (3) review of the impact of propulsion system unreliability and unscheduled maintenance on cost of operation, (4) discussion of the reliability and maintainability requirements and guarantees for future engines. Author

N73-19822*# American Airlines, Inc., New York.

AN AIRLINE STUDY OF ADVANCED TECHNOLOGY REQUIREMENTS FOR ADVANCED HIGH SPEED COMMERCIAL TRANSPORT ENGINES. 3: PROPULSION SYSTEM REQUIREMENTS

G. Phillip Sallee Mar. 1973 85 p 3 Vol.

(Contract NAS3-15572)

(NASA-CR-121134) Avail: NTIS HC $6.25 CSCL 21E

The advanced technology requirements for an advanced

high speed commercial transport engine are presented. The results of the phase 3 effort cover the requirements and objectives for future aircraft propulsion systems. These requirements reflect the results of the Task 1 and 2 efforts and serve as a baseline for future evaluations, specification development efforts, contract/purchase agreements, and operational plans for future subsonic commercial engines. This report is divided into five major sections: (1) management objectives for commercial propulsion systems, (2) performance requirements for commercial transport propulsion systems, (3) design criteria for future transport engines, (4) design requirements for powerplant packages, and (5) testing. Author

N73-19823*# TRW Systems Group, Redondo Beach, Calif.
ELECTROSTATIC PROPULSION BEAM DIVERGENCE EFFECTS ON SPACECRAFT SURFACES, VOLUME 2 Final Report
David F. Hall 17 Jan. 1973 205 p refs Prepared for JPL (Contract NAS7-100; JPL-952350)
(NASA-CR-131092; TRW-11985-6002-RU-00-Vol-2) Avail: NTIS HC $12.25 CSCL 21C

The third phase of a program to develop understanding of and tolerance-level criteria for the deleterious effects of electrostatic rocket exhaust (Cs, Cs(+), Hg, Hg(+)) and materials of rocket construction impinging on typical classes of spacecraft (S/C) surfaces was completed. Models of ion engine effluents and models describing the degradation of S/C surfaces by these effluents are presented. Experimental data from previous phases are summarized and Phase 2 data and analysis are presented in detail. The spacecraft design implications of ion engine contaminants are discussed. Author

N73-19824*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND EVALUATION OF COMBUSTORS FOR REDUCING AIRCRAFT ENGINE POLLUTION
Robert E. Jones and Jack Grobman 1973 19 p refs Presented at 41st Meeting of AGARD/Propulsion and Energetics Panel, London, 9-13 Apr. 1973
(NASA-TM-X-68192; E-7334) Avail: NTIS HC $3.00 CSCL 21E

Efforts in reducing exhaust emissions from turbine engines are reported. Various techniques employed and the results of testing are briefly described and referenced for detail. The experimental approaches taken to reduce oxides of nitrogen emissions include the use of: (1) multizone combustors incorporating reduced dwell times, (2) fuel-air premixing, (3) air atomization, (4) fuel prevaporization, and (5) gaseous fuel. Since emissions of unburned hydrocarbons and carbon monoxide are caused by poor combustion efficiency at engine idle, the studies of fuel staging in multizone combustors and air assist fuel nozzles have indicated that large reductions in these emissions can be achieved. Also, the effect of inlet-air humidity on oxides of nitrogen was studied as well as the very effective technique of direct water injection. The emission characteristics of natural gas and propane fuels were measured and compared with those of ASTM-A1 kerosene fuel. Author

N73-19825*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSTANTANEOUS DISTORTION INVESTIGATION
James E. Calogeras 1972 19 p Presented at the Tech. Interchange Meeting of Air Inlets and Diffusers Panel, Naval Aeroballistics Comm., Dahlgren, Va., 19 Sep. 1972
(NASA-TM-X-68189; E-7329) Avail: NTIS HC $3.00 CSCL 21E

The results obtained in an inlet-engine compatibility test run in the 10x10 SWT of the NASA-Lewis Research Center are reviewed. This program was run to measure the time-variant distortions produced in a supersonic inlet and to relate a unique distortion peak, occurring in an instant of time, to the origin of stall in a compressor. The major stumbling block in this type of effort is the determination of a proper increment of time over which to average pressures before computing distortions. It is reasonable to expect that the proper averaging time is related to the particular compressor in question. The most significant point reported is that the proper averaging time may not be solely dependent on a particular compressor, and, in fact, may vary with operating conditions, even for the same inlet-engine combination. Author

N73-19826*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF AN INTEGRAL FAN LIFT/CRUISE ENGINE FOR A 100 PASSENGER VTOL TRANSPORT
Kestutis C. Civinskas Jan. 1973 36 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TM-X-68186; E-7304) Avail: NTIS HC $4.00 CSCL 21E

A simplified mission analysis was performed to determine an optimum engine cycle for a 100-passenger VTOL transport with a range of 500 statute miles. The aircraft had a total of eight integral fan lift engines, three of which serve as cruise engines. Fan pressure ratio was varied from 1.2 to 1.3, overall pressure ratio from 7 to 13, and turbine inlet temperature from 2460 to 2860 R. Bypass ratio was selected to meet a 500-foot altitude flyover noise goal of 95 PNdB. Airplane gross weight and direct operating cost (DOC) were calculated. The lowest DOC of 1.82 cents per seat-mile was achieved with a fan pressure ratio of 1.3, overall pressure ratio of 12, and turbine inlet temperature of 2860 R. Author

N73-19827*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY. EXECUTIVE SUMMARY Final Report
P. J. Kelly and T. F. Schweickert 29 Dec. 1972 48 p refs (Contract NAS9-12013)
(NASA-CR-128818; MDC-E0674; MSC-04423-1) Avail: NTIS HC $4.50 CSCL 21H

The development and characteristics of an auxiliary propulsion system for space shuttle applications are presented. The system design data necessary for selection of preferred system concepts and the requirements for complementing component design and test programs are analyzed. The use of cryogenic oxygen and hydrogen as a propellant combination is explained on the basis of high vehicle impulse requirements, safety factors, reuse, and logistics considerations. The final configurations for the alternate propellant system, with primary emphasis on earth storable propellants is described. Author

N73-19828*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY. PHASE A REPORT: REQUIREMENTS DEFINITION
G. F. Orton and T. F. Schweickert 15 Feb. 1972 62 p refs (Contract NAS9-12013)
(NASA-CR-128820; MDC-E0603; MSC-04423-3) Avail: NTIS HC $5.25 CSCL 21H

The analyses and rationale used to develop requirements for the oxygen-hydrogen auxiliary propulsion systems to be used with the space shuttle are presented. The requirements apply to a fully reusable space shuttle vehicle system using internal, reusable main engine propellant tanks in both the orbiter and booster stages. Requirements of principal interest are engine thrust, number of engines, maximum system thrust, total impulse, and total impulse expenditure history. Author

N73-19829*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY. PHASE B REPORT: CANDIDATE RCS CONCEPT COMPARISONS
G. F. Orton and T. F. Schweickert 15 Feb. 1972 223 p refs (Contract NAS9-12013)
(NASA-CR-128823; MDC-E0567) Avail: NTIS HC $13.25 CSCL 21H

The competing auxiliary propulsion concepts for the reusable space shuttle vehicle are defined. The concepts are compared on the basis of selection criteria such as weight, reliability, and technology requirements. Propulsion systems using both cryogenic oxygen-hydrogen and earth storable propellants were considered. Three high value oxygen-hydrogen reaction control system concepts were evaluated. The final comparisons demonstrate that all three concepts are viable design approaches. The flexibility

and growth potential of the parallel concept are considered to provide an advantage over the series concept. Author

N73-19830*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY. PHASE C REPORT: OXYGEN-HYDROGEN RCS/OMS INTEGRATION STUDY
A. E. Bruns and W. W. Regnier 15 Jun. 1972 90 p refs
(Contract NAS9-12013)
(NASA-CR-128821; MDC-E0523; MSC-04423-4) Avail: NTIS HC $6.50 CSCL 21H

A comparison of the concepts of auxiliary propulsion systems proposed for the space shuttle vehicle is discussed. An evaluation of the potential of integration between the reaction control system and the orbit maneuvering system was conducted. Numerous methods of implementing the various levels of integration were evaluated. Preferred methods were selected and design points were developed for two fully integrated systems, one partially integrated system, and one separate system. Author

N73-19831*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY. PHASE D REPORT: OXYGEN-HYDROGEN SPECIAL RCS STUDIES
T. L. Baumann, T. C. Pattern, and H. B. McKee 15 Jun. 1972 150 p refs
(Contract NAS9-12013)
(NASA-CR-128822; MDC-E0615) Avail: NTIS HC $9.50 CSCL 21H

Two alternate oxygen-hydrogen auxiliary propulsion system concepts for use with the space shuttle vehicle were evaluated. The two concepts considered were: (1) gaseous oxygen-hydrogen systems with electric or hydraulic motor driven pumps to provide system pressure and (2) liquid oxygen-hydrogen systems which delivered propellants to the engines in a liquid state without the need for pumps. The various means of implementing each of the concepts are compared on the basis of weight, technology requirements, and operational considerations. It was determined that the liquid oxygen-hydrogen system concepts have the potential to produce substantial weight reductions in the space shuttle orbiter total impulse range. Author

N73-19832*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY. PHASE C AND E REPORT: STORABLE PROPELLANTS, RCS/OMS/APU INTEGRATION STUDY
D. D. Anglim, A. E. Bruns, D. C. Perryman, and D. L. Wieland 29 Dec. 1972 382 p refs
(Contract NAS9-12013)
(NASA-CR-128819; MDC-E0708; MSC-04423-2) Avail: NTIS HC $21.25 CSCL 21H

Auxiliary propulsion concepts for application to the space shuttle are compared. Both monopropellant and bipropellant earth storable reaction control systems were evaluated. The fundamental concepts evaluated were: (1) monopropellant and bipropellant systems installed integrally within the vehicle, (2) fuel systems installed modularly in nose and wing tip pods, and (3) fuel systems installed modularly in nose and fuselage pods. Numerous design variations within these three concepts were evaluated. The system design analysis and methods for implementing each of the concepts are reported. Author

N73-19833# Joint Publications Research Service, Arlington, Va.
POWER SYSTEMS FOR SPACECRAFT, PART 1
A. A. Kulandin, S. V. Timashev, and V. P. Ivanov 30 Mar. 1973 271 p refs Transl. into ENGLISH from the book "Energeticheskiye Sistemy Kosmicheskikh Apparatov" Mashinostroyeniye Izdatel'stvo, Moscow, 1972 427 p
(JPRS-58612-1-Pt-1) Avail: NTIS HC $15.75

Discussion is made of the problems of the structure, operating principles, and theoretical fundamentals of the operating process of spacecraft onboard power and propulsion systems. The authors have selected the following order of discussion: primary energy sources (nuclear, solar); converters of primary energy to electric power; devices for removal of unused heat; and various types of power and propulsion systems. In conclusion, a chapter is presented on the complete investigation of a single onboard power system for spacecraft, as the synthesis of its basic elements. Author

N73-19834# Joint Publications Research Service, Arlington, Va.
POWER SYSTEMS FOR SPACECRAFT, PART 2
A. A. Kulandin, S. V. Timashev, and V. P. Ivanov 30 Mar. 1973 196 p refs Transl. into ENGLISH from the book "Energeticheskiye Sistemy Kosmicheskikh Apparatov" Mashinostroyeniye Izdatel'stvo, Moscow, 1972 427 p
(JPRS-58612-2-Pt-2) Avail: NTIS HC $12.00

A discussion is made of problems concerning the structure, operating principles, and theoretical fundamentals of the operating process of onboard power and propulsion systems. These include gas and vapor-liquid power plants, thermoelectric and thermoemission systems, electrothermal and electromagnetic jet engines, and chemical power plants. J.M.M.

N73-19835# Societe Europeenne de Propulsion, Puteaux (France).
PRELIMINARY DESIGN STUDY OF SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM Final Report
M. Pouliquen Aug. 1971 103 p Prepared for Cryorocket Sponsored by ELDO
(SEP-NT-3054/71-M) Avail: NTIS HC $7.25

The performance is evaluated of an attitude control system with turbopump fed chambers (high pressure system) for the space shuttle. Three operating diagrams show that if the feed modes of the turbines and the heat exchangers are considered, a series mounting of the generator, heat exchanger, and turbine, and a series mounting of generator, turbine, and heat exchanger perform similarly (Isp 352 sec.). If the turbines and exchangers are fed in parallel, overall specific impulse is reduced to 328 sec. The feasibility of integrating the attitude control propulsion subsystem into the orbital maneuvering subsystem is evaluated and optimization criteria are given for the pumps. The feasibility and dimensioning of the boost-pumps operating at zero NPSH are also discussed. ESRO

N73-19836# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
STUDY ON A COMBINED OMS/ACPS PROPULSION SYSTEM Final Report
Aug. 1971 89 p Prepared for Cryorocket Sponsored by ELDO
(MBB Proj. 6.230.0)
(MBB-UR-82-71) Avail: NTIS HC $6.50

The results of a study on a combined OMS (orbital maneuvering subsystem)/ACPS (attitude control propulsion subsystem) for the space shuttle are summarized. In this system, the OMS and the ACPS thrusters are supplied by a common turbopump unit. As the OMS thrust required is in the range of 5 t, the 5 t engine design of the European space tug was used as a baseline OMS engine, and the only modifications made were those necessary to meet the combined OMS/ACPS requirements. For the combined system analysis, it was assumed that one turbopump unit must be able to supply alternatively one OMS thruster and four ACPS thrusters of 1 t thrust each. Several design solutions concerning the arrangement of the heat exchanger and the use of a second gas generator working as a reburner, which would increase the flexibility of the system, are considered. Performance of these configurations was analyzed and compared in terms of nominal design point and compactness. Author (ESRO)

N73-19837# Cryorocket, Neuilly (France).
STUDY AND TECHNOLOGICAL WORK ON SOME ASPECTS OF THE US SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM Final Report, 1 Mar. - 31 Jul. 1971
30 Aug. 1971 31 p Prepared for Cryorocket Sponsored by ELDO
(Rept-D-9/71-MK/DH) Avail: NTIS HC $3.75

The work on the APS (auxiliary propulsion system) for the space shuttle, which consists of an ACPS (attitude control propulsion subsystem) and the OMS (orbital maneuvering subsystem) is summarized. A system analysis was conducted for both a single ACPS and an integrated APS (i.e. ACPS and

OMS using the same turbopump). The results were evaluated and the configurations compared. No primary feasibility or technology problems were revealed by this study. A test program was conducted in parallel to evaluate the capability of existing bearing and seal technology in LH2 and LOX under expected cycle conditions. The design of an integrated APS using a previous space tug engine design proved to be feasible. Author (ESRO)

N73-19838# Naval Postgraduate School, Monterey, Calif.
MODELS OF CLOSED-LOOP USE/REPAIR CYCLES WITH APPLICATION TO THE DD-963 MAIN PROPULSION ENGINES M.S. Thesis
Samuel Stephenson Montgomery and Paul Frederick Schissler, Jr. Sep. 1972 63 p refs
(AD-753622) Avail: NTIS CSCL 21/5

The report describes and compares two models which may be used as tools in making logistic support decisions for closed-loop systems, such as the use/repair cycle of the LM-2500 gas turbine engines. The models are then used to study the effect of changes in various system parameters. The models are a computer simulation developed by Cushing, Gautier, and Long and an analytical model developed by Koenigsberg. The steady-state behavior of both models is essentially the same, with the analytical model consistently more conservative than the simulation model. Author (GRA)

N73-19839# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONSTRUCTION AND DESIGN OF ROCKET ENGINES
V. A. Volodin 27 Oct. 1972 146 p refs Transl. into ENGLISH from the monograph "Konstruktsiya i Proektirovanie Raketnykh Dvigatelei" Moscow, 1971 p 131-207, 239-269
(AD-754320; FTD-HT-23-1442-72) Avail: NTIS CSCL 21/8

The report gives a general survey, classification, and brief description of rocket engines and their working substances. It presents the principles for the construction and design of rocket engines operating on liquid and solid chemical propellants. The textbook is intended for students at machine-construction technical schools. It can be useful to engineering and technical personnel engaged in rocket engine construction. Author (GRA)

N73-19840# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF DISCHARGING COOLING AIR INTO THE AIR-GAS FLOW AREA OF A TURBINE ON THE COST EFFECTIVENESS OF A HIGH TEMPERATURE GAS TURBINE ENGINE
V. R. Lezhoev and Yu. I. Mityushkin 11 Nov. 1972 18 p refs Transl. into ENGLISH from Tr. Korablestroitelnyi Inst. (Leningrad), no. 70, 1970 p 55-62
(AD-753969; FTD-HT-23-1497-72) Avail: NTIS CSCL 21/5

Using the energy of cooling air discharged into the air-gas flow area of a turbine from the nozzle blades and rotor is a means of increasing the effective work of a gas-turbine and the effective efficiency of gas turbines. An increase in relative cooling-air flow rate leads to a relative change not only in the effective efficiency but also the effective work of a turbine. An increase in the difference between the angle of emergence for the gas flow from the cascade and the angle at which cooling air is exhausted from the blades leads to an increase in the relative change in efficiency of a gas turbine engine. GRA

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-19841*# New Hampshire Univ., Durham. Space Science Center.
NEUTRON MEASUREMENTS OF THE OGO-VI SPACECRAFT Final Scientific Report
J. A. Lockwood Jan. 1973 84 p refs
(Contract NAS5-9313; Grant NGR-30-002-008)
(NASA-CR-130181) Avail: NTIS HC $6.25 CSCL 03B

The neutron measurements with the OGO-6 spacecraft are reported. Topics discussed include: the design and calibration of a neutron monitor for measuring the cosmic ray neutron leakages from the earth's atmosphere, determination of latitude dependence of cosmic ray leakage flux, determination of the angular distribution of neutron leakage flux as deduced by measurements of the altitude dependence, and verification of the solar modulation of the cosmic ray source for the neutron leakage. F.O.S.

N73-19842# Institut d'Aeronomie Spatiale de Belgique, Brussels.
ROCKET MEASUREMENT OF SOLAR FLUXES AT 1216 A, 1450 A AND 1710 A
M. Ackerman and P. Simon 1972 13 p refs
(Aeronomica-Acta-111) Avail: NTIS HC $3.00

Values of the solar UV fluxes at 1216 A, 1450 A and 1710 A obtained by means of rocket borne spectrometers are presented. They are compared with other results. Author

N73-19843# Lockheed Missiles and Space Co., Palo Alto, Calif.
PENETRATION OF SOLAR PROTONS INTO THE GEOMAGNETIC TAIL
I. I. Alekseev, A. P. Kropotkin, and V. P. Shabanskii [1972] 5 p refs Transl. into ENGLISH from Geomagn. Aeron. (Moscow), v. 12, no. 6, 1972 p 974-977
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A mechanism by which solar cosmic ray protons penetrate the magnetosphere tail and the polar cap of the ionosphere is proposed. This mechanism is based upon the consideration that proton scattering by magnetic inhomogeneities constitutes a regular process instead of diffusion. Proton energies in the range of 0.5 to 40 MeV are considered, and it is concluded that the theoretical model is in agreement with observed proton behavior. J.M.M.

N73-19844*# Oak Ridge National Lab., Tenn.
CALCULATIONS OF NEUTRON FLUX SPECTRA INDUCED IN THE EARTH'S ATMOSPHERE BY GALACTIC COSMIC RAYS
T. W. Armstrong, K. C. Chandler, and J. Barish Oct. 1972 39 p refs Submitted for publication
(NASA Order H-38280A; Contract W-7405-eng-26)
(NASA-CR-131158; ORNL-TM-3961) Avail: NTIS HC $4.00 CSCL 03B

Calculations have been carried out to determine the neutron flux induced in the earth's atmosphere by galactic protons and alpha particles at solar minimum for a geomagnetic latitude of 42 N. Neutron flux spectra were calculated using Monte Carlo and discrete ordinates methods, and various comparisons with experimental data are presented. The magnitude and shape of the calculated neutron-leakage spectrum at the particular latitude considered support the theory that the cosmic-ray-albedo-neutron-decay mechanism is the source of the protons and electrons trapped in the Van Allen belts. Author (NSA)

N73-19845# Bergen Univ. (Norway). Dept. of Physics.
HIGH LATITUDE ELECTRON AND PROTON PRECIPITATION AT DIFFERENT LOCAL TIMES AND MAGNETIC ACTIVITY
R. Amundsen, K. Aarsnes, H. R. Lindalen, F. Soeraas, and G. Skovli (Norwegian Defence Res. Estab.) Oct. 1971 21 p refs
(NP-19465; Rept-37) Avail: AEC Depository Libraries

Data are presented from simulataneous satellite measurements of electron and proton precipitation at high latitudes. The data are sampled in different local time sectors and at different geomagnetic activity levels permitting a presentation of some characteristic features and modes of behavior of electron and proton precipitation during different conditions. The latitudinal position and displacement of the precipitation zones versus local time and geomagnetic activity are described as well as the relative importance of the two particle species regarding flux values. The energy ranges studied are for protons between 115 and 180 keV and for electrons greater than 40 keV.
Author (NSA)

N73-19846# Bergen Univ. (Norway). Dept. of Physics.
PITCHANGLE DISTRIBUTIONS OF (100 TO 300) keV PROTONS MEASURED BY THE ESRO 1B SATELLITE

R. Amundsen, F. Soeraas, H. R. Lindalen, and K. Aarsnes Jul. 1971 27 p refs Sponsored by Roy. Norwegian Council for Sci. and Ind. Res.
(NP-19464; Rept-36) Avail: AEC Depository Libraries

The pitch-angle distribution of 100- to 300-keV protons, in the early morning - late afternoon local magnetic time sector, was studied by using data from the early life time of the ESRO 1B (Boreas) satellite. The pitch-angle distribution is described as a function of invariant latitude for different geomagnetic activity levels. On the night side, going polewards, the particle fluxes were found to peak at 90 deg, followed by a latitude range with isotropy. On the day side, two precipitation zones were found during slight disturbances, the poleward one showing an isotropic pitchangle distribution and the equatorward one an anisotropic distribution peaked at 90 deg. During disturbed conditions, the two zones merge and the region of isotropic pitch-angle distribution expands. The particle loss cones were determined and compared with theoretical ones in a realistic field model. Author (NSA)

N73-19847# Universidad Mayor de San Andres, La Paz (Bolivia). Lab. de Fisica Cosmica.
[PHYSICS OF HIGH ENERGY PARTICLES, COSMIC SHOWERS, MODULATION OF COSMIC RAYS, HIGH ATMOSPHERIC METEOROLOGY, AND APPLICATION OF SOLAR RADIATION TO OTHER AREAS OF SCIENCE]
Gaston R. Mejia, ed May 1971 343 p refs In SPANISH
(NP-19366; Rept-43) Avail: AEC Depository Libraries

The results of a series of studies made in Bolivia on the physics of high energy particles, cosmic showers, modulation of cosmic rays, high atmospheric meteorology, and application of solar radiation to other areas of science are presented in a synthetic form. The studies presented include a preliminary analysis of the cosmic ray storm of January 26, 1968, the density gradient of cosmic rays perpendicular to the ecliptic plane, anisotropies of cosmic rays perpendicular to the ecliptic plane, observations of high energy nuclear explosions in Chacaltaya, accompanying energetic nucleons in the atmosphere, high stability instruments for the investigation of the angular distribution in the galaxy of charged particles, coincident radiopulses, lateral distribution of radiopulses in Chacaltaya, simultaneous observations in Chacaltaya of three frequencies of radiopulses, abnormal component of atmospheric muons, reexamination of the abnormal zenithal distribution, zenithal distribution of atmospheric muons of Chacaltaya, variation of the pressure in Chacaltaya, exploitation of solar energy, the El Alto radioprobe station and its physical parameters, neutron monitor, and meson telescope. NSA

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-19848 Virginia Univ., Charlottesville.
ON THE OPTICAL ROTATING INTENSITY MODULATOR Ph.D. Thesis
Fred Delano Rosenberg 1972 69 p
Avail: Univ. Microfilms Order No. 72-23440

The optical rotating intensity modulator is a method for measuring the positions and magnitudes of stars. A Ronchi ruling, rotating in the focal plane of a telescope, modulates the light from the stars in the field. The form of the signal can be analyzed to determine the positions and magnitudes of all of the stars in the field. The form of the measured signals, data reduction schemes, efficient transform for data reduction, and precise least squares data reduction method are described. Observational results, obtained using the prototype equipment and reduced using the least-squares data reduction method developed, are presented to demonstrate that the optical rotating intensity modulator technique can measure positions and magnitudes of double and multiple star systems as well as, or better than, any other present techniques. Dissert. Abstr.

N73-19849 Georgetown Univ., Washington, D.C.
AN ANALYSIS OF THE CORRELATION BETWEEN CERTAIN MARTIAN PHENOMENA AND THE THEORY OF THE OXIDES OF NITROGEN Ph.D. Thesis
Richard Harold Munis 1972 87 p
Avail: Univ. Microfilms Order No. 72-23403

It can be shown in the radiometric equation for computing Martian surface temperatures, that a certain amplitude of deviation can be predicted which corroborates temperature deviations exhibited in data taken during a seventeen year period in an effort to record random brightness fluctuations on Mars. Anomalous temperature changes have been recorded on clear Martian days as well as on days when the surface of the planet was obscured by the yellow clouds. The areographic location of a significant number of these temperature changes occurs at the Martian location where phase changes would occur as predicted by the theory that the oxides of nitrogen are present on Mars. Dissert. Abstr.

N73-19850*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 17, 30 DAY FAILURE AND ANOMALY LISTING REPORT
Feb. 1973 41 p
(NASA-TM-X-69122; MSC-07762) Avail: NTIS HC $4.25 CSCL 22B

The significant anomalies that occurred during the Apollo 17 mission are investigated. The discussion is divided into five major sections: command and service modules, lunar module, government-furnished equipment, lunar surface experiments, and orbital experiments. All times are elapsed time from range zero, established as the integral second before lift-off. Author

N73-19851*# Martin Marietta Corp., Denver, Colo.
ASTRONOMY SORTIE MISSIONS DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Sep. 1972 70 p refs Prepared in cooperation with Bendix Corp., Denver, Colo. and Itek Corp., Lexington, Mass.
(Contract NAS8-28144)
(NASA-CR-124042; AM-1002-1004-Vol-1) Avail: NTIS HC $5.50 CSCL 03A

A study was conducted to determine if a group of existing astronomy experiments with stated scientific objectives could be accommodated by the sortie mission. Additional goals of the study included defining the operational concept, the support hardware, mission profiles, and the kind of interfaces that would be required with the space shuttle and sortie lab. The results of the study are presented and indicate that the astronomy sortie mission concept: (1) is technically feasible using present-day technology with a few exceptions, (2) is responsive to the stated scientific objectives, and (3) does provide an important contribution to the overall space astronomy program. D.L.G.

N73-19852*# Kanner (Leo) Associates, Redwood City, Calif.
PRELIMINARY RESULTS OF INFRARED MEASUREMENT OF THE MARS SURFACE TEMPERATURE BY THE MARS-3 AUTOMATIC INTERPLANETARY STATION
V. I. Mordz, L. V. Ksanfomaliti, A. M. Kasatkin, G. N. Krasovskiy, N. A. Parfentyev, G. N. Davydov, and G. F. Filippov Washington NASA Mar. 1973 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 208, no. 2, 1973 p 299 - 302
(Contract NASw-2481)
(NASA-TT-F-14837) Avail: NTIS HC $3.00 CSCL 03B

Infrared measurements of the brightness temperatures of the Martian surface were made by the Mars-3 automatic interplanetery station, in the 8-40 microrange. Plots of the Mars-3 measurement tracks during December 1971, January and February 1972 are presented. Results of measurements of the 28 February 1972 and 15 December 1971 tracks, during and after the dust storm, are presented graphically. These measurements, during and after the dust storm, indicate an antigreenhouse effect, and they confirm that dust plays a part in the thermal regime of the Martian atmosphere. The thermal inertia parameter is in good agreement with the results of ground observations and radiometric measurements by Mariner 6 and 7, although observations of the Cerberus region indicate that the thermal inertia also changes. Author

N73-19853# Royal Aircraft Establishment, Farnborough (England).
STAR SIMULATOR CALIBRATION BASED ON THE SPECTRUM OF VEGA
A. G. Gleave Oct. 1972 29 p refs
(PD-15514; RAE-TR-72138; BR-32109) Avail: NTIS HC $3.50

The photometric calibration of the star simulator, based on data on the spectrum of the standard star alpha-Lyrae (Vega), of stellar class AOV is described. A calibration check and results of ground-based and in-flight sensor checks on the calibration indicate that the calibration accuracy achieved is well within that required for star sensor calibration tests. The spectra of several AOV type stars in the visible and ultraviolet spectral regions are discussed, the latter being derived from the spacecraft observations during the last decade. The problems associated with extending the spectral range of the simulated star are considered briefly. Author

N73-19854# Outokumpu Oy, Tapiola (Finland). Aarne Karjalainen Observatory.
THE SHORT PERIODIC PERTURBATIONS IN SATURN'S RINGS
P. Vaaraniemi 1973 20 p refs
(Rept-14) Avail: NTIS HC $3.00

The short periodic perturbations in Saturn's rings were calculated. The effects studied include the influence of Saturn's moons, of its oblateness, and of solar radiation pressure. The perturbations caused by the satellites and oblateness are considered minor phenomena compared to the effect of radiation pressure on inclinations in short periods of time. This effect, it is thought, may constitute a mechanism that prevents a full flattening of the ring system. Author

N73-19855# Oulu Univ. (Finland). Aarne Karjalainen Observatory.
THE DARK SIDE ILLUMINATION OF SATURN'S RINGS
K. A. Haemeen-Anttila 1972 12 p refs
(Rept-13) Avail: NTIS HC $3.00

The effective optical thickness of Saturn's rings along the cross-section studied is evaluated by means of the intensity of radiation transmitted through the rings. The most probable value, including the contribution of gaps, is 0.2. A large fraction of dark-side illumination is produced by single scattering in gaps having an optical thickness of 0.0001 to 0.001. Author

N73-19856# Royal Greenwich Observatory, Herstmonceux (England).
UBV OBSERVATIONS OF THE RR LYRAE VARIABLE HD 176387 (MT TELESCOPII)
J. B. Alexander 1972 10 p refs
(Bull-174) Avail: NTIS HC $3.00; Roy. Greenwich Obs., Herstmonceux £0.20

UBV observations of HD 176387 made in 1970 are described. The significance of the anti-clockwise loop performed by the star in the U-B, B-V plane is discussed. Author

N73-19857# Royal Greenwich Observatory, Herstmonceux (England).
THE MASS-LUMINOSITY RELATIONSHIP OF THE HYADES AND OTHER STARS
J. B. Alexander 1972 9 p refs
(Bull-175) Avail: NTIS HC $3.00; Roy. Greenwich Obs., Herstmonceux £0.20

The mass-luminosity relationship of the Hyades cluster is discussed and the conclusions of a previous paper are confirmed. Although the mass-luminosity relationship of the cluster is poorly determined at present, it is probable that the unevolved stars in the Hyades are somewhat undermassive when compared with typical unevolved field stars of the corresponding luminosity. For stars in the general field, there is no evidence for discrete mass-luminosity relationships. Author

N73-19858# Royal Greenwich Observatory, Herstmonceux (England).
UBV PHOTOELECTRIC OBSERVATIONS. 1: STARS WITHIN 25 PARSECS OF THE SUN. 2: STARS IN QUASAR AND GALAXY FIELDS. 3: STARS IN KAPTEYN SELECTED AREAS. 4: MISCELLANEOUS STARS
Elizabeth A. Epps 1972 21 p refs
(Bull-176) Avail: NTIS HC $3.25; Roy. Greenwich Obs., Herstmonceux £0.40

UBV photometry is presented for 115 stars within 25 parsecs of the Sun for bright secondary standards in ten quasar fields and ten galaxy fields, and for stars in eleven Kapteyn Selected Areas. In addition, UBV data are given for several miscellaneous stars including R CrB, delta Cep C, six M supergiants, five red giants in M67, and four horizontal branch stars. Author

N73-19859*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
A TECHNIQUE FOR COMPUTATION OF STAR MAGNITUDES RELATIVE TO AN OPTICAL SENSOR
Jack W. Rhoads 30 Dec. 1972 35 p refs
(Contract NAS7-100)
(NASA-CR-130926; JPL-TM-33-586) Avail: NTIS HC $3.75 CSCL 03A

The theory and techniques used to compute star magnitudes relative to any optical detector (such as the Mariner Mars 1971 Canopus star tracker) are described. Results are given relative to various star detectors. Author

N73-19860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC HYSTERESIS CLASSIFICATION OF THE LUNAR SURFACE AND THE INTERPRETATION OF PERMANENT REMANENCE IN LUNAR SURFACE SAMPLES
Peter Wasilewski Jun. 1972 27 p refs Submitted for publication
(NASA-TM-X-65941; X-644-72-159) Avail: NTIS HC $3.50 CSCL 03B

A magnetic hysteresis classification of the lunar surface is presented. It was found that there is a distinct correlation between natural remanence (NRM), saturation magnetization, and the hysteresis ratios for the rock samples. The hysteresis classification is able to explain some aspects of time dependent magnetization in the lunar samples and relates the initial susceptibility to NRM, viscous remanence, and to other aspects of magnetization in lunar samples. It is also considered that since up to 60% of the iron in the lunar soil may be super paramagnetic at 400 K, and only 10% at 100 K, the 50% which becomes ferromagnetic over the cycle has the characteristics of thermoremanence and may provide for an enhancement in measurable field on the dark side during a subsatellite magnetometer circuit. Author

N73-19861*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROVISIONAL HOURLY VALUES OF EQUATORIAL Dst FOR NOVEMBER AND DECEMBER 1972
M. Sugiura (CSC) and D. J. Poros Mar. 1973 4 p
(NASA-TM-X-66197; X-645-73-75) Avail: NTIS HC$3.00 CSCL 03B

Tables covering provisional hourly values of equatorial Dst for November and December 1972 are presented. E.H.W.

N73-19862*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PARTICLE SHAPE AND MAGNETIZATION OF CHONDRITE METEORITES, LUNAR SAMPLES, AND IMPACTITES
Peter Wasilewski Jun. 1972 32 p refs
(NASA-TM-X-65942; X-644-72-161) Avail: NTIS HC $3.75 CSCL 03B

Extra terrestrial materials, certain materials which have their origin at the earth's surface due to meteoritic impact, or under highly reducing conditions, such as in the case of basaltic flows in contact with coal beds or serpentenites, all contain Fe and FeNi phases with high magnetization values and spherical shape. Normally, the demagnetizing field (H sub D = NI sub S: where N is the demagnetizing factor and I is the saturation magnetization) is corrected for. In disperse systems, such as most natural materials, the particle shape effects are analyzed in terms of the saturation fields, Hs = H sub D = NI sub S and the magnetization differences (Delta I sub S). Discrete size modes of superparamagnetic (SP), multidomain (MD), and single domain (SD) particles result in reduced coercive force (Hc), increase in the value R sub H (ratio of remanent coercive force, H sub R, to H sub C), and decrease in the value R sub I (ratio of remanent

magnetization, I sub R, to saturation magnetization, T sub S). The main distinctions between the various natural materials can be made by this approach. Hysteresis loops for terrestrial basalts, Fe and Ni rods and spheres, chondrite meteorites, lunar samples, impactites, and chondritic fusion crust are presented. Author

N73-19863*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYSTEM DESCRIPTION AND OPERATING GUIDE FOR DSAS ILLUMINATION AND MOON CONFLICT PROGRAMS
S. Chris Dunker Jan. 1973 48 p refs
(NASA-TM-X-66200; X-581-73-44) Avail: NTIS HC $4.50 CSCL 03A

The DSAS Illumination and Moon Conflict programs are described which will provide the times during an orbit when the DSAS (Digital Solar Aspect Sensor) will record the direct rays of the sun, and the periods of time when the horizon scanners will come in conflict with the moon. The DSAS Illumination Program makes use of an orbit tape (or epoch time and orbital elements) in addition to an ephermeris tape containing positions of the sun and moon. The Moon Conflict Program makes use of the same ephemeris tape with sun and moon positions, but uses only epoch time and orbital elements for the satellite positions. These programs were designed for the TIROS or ITOS series spacecraft but may be utilized by any spacecraft with similar sensors. Author

N73-19864*# Stanford Univ., Calif. Inst. of Plasma Research.
THE LUMINOSITY FUNCTION OF QUASARS AND ITS EVOLUTION: A COMPARISON OF OPTICALLY SELECTED QUASARS AND QUASARS FOUND IN RADIO CATALOGS
V. Petrosian Jan. 1973 48 p refs
(Grants NGR-05-020-510; NSF GP-23840)
(NASA-CR-131111; SUIPR-502) Avail: NTIS HC $4.50 CSCL 03A

The luminosity function of quasars and its evolution are discussed, based on comparison of available data on optically selected quasars and quasars found in radio catalogs. It is assumed that the red shift of quasars is cosmological and the results are expressed in the framework of the Lambda = 0, Q sub Q = 1 cosmological model. The predictions of various density evolution laws are compared with observations of an optically selected sample of quasars and quasar samples from radio catalogs. The differences between the optical luminosity functions, the red shift distributions and the radio to optical luminosity ratios of optically selected quasars and radio quasars rule out luminosity functions where there is complete absence of correlation between radio and optical luminosities. These differences also imply that Schmidt's (1970) luminosity function, where there exists a statistical correlation between radio and optical luminosities, although it may be correct for high red shift objects, disagrees with observation at low red shifts. These differences can be accounted for by postulating existence of two classes (1 and 2) of objects. Author

N73-19865*# TRW Systems, Redondo Beach, Calif. Propulsion Systems Section.
APOLLO 16 LM-11 DESCENT PROPULSION SYSTEM FINAL FLIGHT EVALUATION
A. T. Avvenire Jan. 1973 57 p refs
(Contract NAS9-12330)
(NASA-CR-128826; TRW-20029-H156-R0-00) Avail: NTIS HC $5.00 CSCL 22C

The performance of the LM-11 Descent Propulsion System during the Apollo 16 Mission was evaluated and found to be satisfactory. The average engine effective specific impulse was 0.1 second higher than predicted, but well within the predicted 1 sigma uncertainty of 0.2 seconds. The engine performance corrected to standard inlet conditions for the FTP portion of the burn at 50 seconds after ignition was as follows: thrust, 9839 lbf; specific impulse, 306.9 sec; and propellant mixture ratio, 1.592. These values are +0.34, +0.03 and +0.0 percent different, respectively, from the values reported from engine acceptance tests and were within specification limits. Several flight measurement discrepancies that existed during the flight are discussed. Author

N73-19866*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
ULTRAVIOLET BRIGHTNESS OF CELESTIAL TARGETS FOR APOLLO 17
William G. Fastie Dec. 1972 70 p
(Contract NAS9-11528)
(NASA-CR-128834) Avail: NTIS HC $5.50 CSCL 03A

An evaluation of the ultraviolet flux from the stars expected in the various inertial-hold pointing directions and PTC scans during the Apollo 17 mission is presented. These directions and PTC scan poles for the nominal mission are listed. The methodology used in evaluating the flux and the individual targets themselves is explained. Author

N73-19867*# Technology, Inc., San Antonio, Tex. Life Sciences Div.
SPECIAL TECHNICAL SERVICES FOR INVESTIGATION OF LIGHT FLASH PHENOMENA Final Report, 1 Jul. 1971 - 1 Feb. 1973
Mar. 1973 15 p refs
(Contract NAS9-12081)
(NASA-CR-128866) Avail: NTIS HC $3.00 CSCL 03B

Details are presented of an investigation aimed at an explanation of the phenomenon of light flashes observed by Apollo crew members. The various theories considered include: penetration of the eye by cosmic particles resulting in retinal stimulation; production of phosphenes or sensations of light through ionization or excitation; appearance of heavily ionized single tracks misinterpreted as light flashes; Cerenkov radiation; and direct excitation of neural tissue by penetrating cosmic rays. It is concluded that the latter two theories are the most likely mechanisms for the development of a definitive explanation. J.M.M.

N73-19114* Techtran Corp., Glen Burnie, Md.
EVOLUTION OF THE PROBLEM OF DETECTING ORGANIC MATTER IN THE SOLAR SYSTEM
L. M. Pozharitskaya, B. A. Starostin, and R. B. Zezin *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 336-350 refs
(For availability see N73-19077 10-04)
CSCL 03B

N73-19115* Techtran Corp., Glen Burnie, Md.
EFFECT ON INFUSORIA OF PHYSICAL CONDITIONS WHICH SIMULATE THE ENVIRONMENT ON THE SURFACE OF THE PLANET MARS
L. K. Lozina-Lozinskiy, V. N. Bychenkova, and E. I. Zaar *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 351-365 refs
(For availability see N73-19077 10-04)
CSCL 03B

N73-19118* Techtran Corp., Glen Burnie, Md.
RESISTANCE OF UNICELLULAR ORGANISMS TO ULTRAVIOLET RADIATION IN RELATION TO THE PROBLEM OF THE EXISTENCE OF EXTRATERRESTRIAL LIFE
L. K. Lozina-Lozinskiy *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 378-392 refs (For availability see N73-19077 10-04)
CSCL 03B

N73-19119* Techtran Corp., Glen Burnie, Md.
THE ACTION OF ULTRAVIOLET RADIATION ON AMINO ACIDS AND PEPTIDES IN VARYING GAS ATMOSPHERES IN THE PRESENCE OF SALTS AND OXIDES OF METALS
M. A. Khenokh, N. P. Bogdanova, and Ye. M. Lapinskaya *In its* Probl. of Space Biol., Vol. 16 Feb. 1973 p 393-406 refs
(For availability see N73-19077 10-04)
CSCL 03B

N73-19582* Scientific Translation Service, Santa Barbara, Calif.
CERTAIN NUMERICAL TECHNIQUES OF SOLVING VARIATIONAL PROBLEMS OF FLIGHT DYNAMICS
Z. N. Mamotko, A. Z. Otpushchenko, and L. I. Shatrovskiy *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 221-253 refs (For availability see N73-19572 10-19)
CSCL 22C

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N73-19868*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A STUDY PROGRAM FOR GEODETIC SATELLITE APPLICATIONS Final Report
Michael R. Pearlman Oct. 1972 58 p
(Grant NGR-09-015-002)
(NASA-CR-130180) Avail: NTIS HC $5.00 CSCL 22B

The work is reported on support of the GEOS-C Program, National Geodetic Satellite program, and the Earth Physics Program. The statement of work and a description of the GEOS-C are presented along with the trip reports, and the Earth and Ocean Physics Application program. F.O.S.

N73-19869*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Guidance and Flight Mechanics Dept.
PERFORMANCE ANALYSIS AND DESIGN SYNTHESIS (PADS) COMPUTER PROGRAM. VOLUME 3: USER MANUAL Final Report
Nov. 1972 222 p
(Contract NAS9-12059)
(NASA-CR-128725; MDC-G4287-Vol-3) Avail: NTIS HC $13.25 CSCL 22B

The two-fold purpose of the Performance Analysis and Design Synthesis (PADS) computer program is discussed. The program can size launch vehicles in conjunction with calculus-of-variations optimal trajectories and can also be used as a general purpose branched trajectory optimization program. For trajectory optimization alone or with sizing, PADS has two trajectory modules. The first trajectory module uses the method of steepest descent. The second module uses the method of quasi-linearization, which requires a starting solution from the first trajectory module. Author

N73-19870# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SOUNDING ROCKET PAYLOAD RECOVERY SYSTEMS
Roger Marguet and Jacques Lerat 1972 23 p In FRENCH; ENGLISH summary Presented at Intern. Colloq. on the Basis of Launching, Kourou, French Guiana, 22-28 Nov. 1972
(ONERA-TP-1153) Avail: NTIS HC $3.25

The various systems for recovering sounding rocket payloads are discussed. Emphasis is placed on those used by the French space agency in Guiana. The two main problems are identified as: (1) absorbing the kinetic energy of the payload to prevent impact damage and (2) reducing the recovery zone whose size and position relative to the launching station determine the method to be used. Author

N73-19871*# Marquardt Corp., Van Nuys, Calif.
CHARACTERIZATION OF THE SPACE SHUTTLE REACTION CONTROL SYSTEM ENGINE Final Report
M. S. Wilson, R. C. Stechman, R. B. Edelman, O. F. Fortune, and C. Economos 1 May 1972 338 p refs
(Contract NAS9-11740)
(NASA-CR-128748; TMC-S-1220) Avail: NTIS HC $19.00 CSCL 22B

A computer program was developed and written in FORTRAN 5 which predicts the transient and steady state performance and heat transfer characteristics of a pulsing GO2/GH2 rocket engine. This program predicts the dynamic flow and ignition characteristics which, when combined in a quasi-steady state manner with the combustion and mixing analysis program, will provide the thrust and specific impulse of the engine as a function of time. The program also predicts the transient and steady state heat transfer characteristics of the engine using various cooling concepts. The computer program, test case, and documentation are presented. The program is applicable to any system capable of utilizing the FORTRAN 4 or FORTRAN 5 language. Author

N73-19872*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: EVOLUTION OF THE ATTITUDE TIME LINE
Rocky D. Duncan Washington Mar. 1973 8 p
(NASA-TN-D-7086; MSC-S-353) Avail: NTIS HC $3.00 CSCL 22A

The evolution of the attitude time line is discussed. Emphasis is placed on the operational need for and constraints on the time line and on how these factors were involved in the time line generation procedure. Examples of constraints on and applications of the complete time line are given. Author

N73-19873*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: POWER GENERATION SYSTEM
David Bell, III and Fulton M. Plauche Washington Mar. 1973 20 p
(NASA-TN-D-7142; MSC-S-347) Avail: NTIS HC $3.00 CSCL 10A

A comprehensive review of the design philosophy and experience of the Apollo electrical power generation system is presented. The review of the system covers a period of 8 years, from conception through the Apollo 12 lunar-landing mission. The program progressed from the definition phase to hardware design, system development and qualification, and, ultimately, to the flight phase. Several problems were encountered; however, a technology evolved that enabled resolution of the problems and resulted in a fully manrated power generation system. These problems are defined and examined, and the corrective action taken is discussed. Several recommendations are made to preclude similar occurrences and to provide a more reliable fuel-cell power system. Author

N73-19874*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: CONSUMABLES BUDGETING
Don A. Nelson Washington Mar. 1973 26 p
(NASA-TN-D-7140; MSC-S-339) Avail: NTIS HC $3.00 CSCL 22C

The procedures and techniques used in predicting the consumables usage for the Apollo mission are discussed. Because of the many interfaces and influences on the consumables system, it is impractical to document all facets of consumables budgeting; therefore, information in this report is limited to the major contributions to the formulation of a consumables budget. Author

N73-19875*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: THE PROBLEM OF STRESS-CORROSION CRACKING
Robert E. Johnson Washington Mar. 1973 20 p refs
(NASA-TN-D-7111; MSC-S-344) Avail: NTIS HC $3.00 CSCL 20K

Stress-corrosion cracking has been the most common cause of structural-material failures in the Apollo Program. The frequency of stress-corrosion cracking has been high and the magnitude of the problem, in terms of hardware lost and time and money expended, has been significant. In this report, the significant Apollo Program experiences with stress-corrosion cracking are discussed. The causes of stress-corrosion cracking and the corrective actions are discussed, in terminology familiar to design engineers and management personnel, to show how stress-corrosion cracking can be prevented. Author

N73-19876*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: SIMULATION OF MANNED SPACE FLIGHT FOR CREW TRAINI[illegible]
C. H. Woodling, Stanley Faber, John J. VanBockel, Charles C. Olasky, Wayne K. Williams, John L. C. Mire, and James R. Homer Washington Mar. 1973 60 p ref
(NASA-TN-D-7112; MSC-S-346) Avail: NTIS HC $3.00 CSCL 05I

Through space-flight experience and the development of

simulators to meet the associated training requirements, several factors have been established as fundamental for providing adequate flight simulators for crew training. The development of flight simulators from Project Mercury through the Apollo 15 mission is described. The functional uses, characteristics, and development problems of the various simulators are discussed for the benefit of future programs. Author

N73-19877*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: DESCENT PROPULSION SYSTEM
William R. Hammock, Jr., Eldon C. Currie, and Arlie E. Fisher Washington Mar. 1973 36 p refs
(NASA-TN-D-7143; MSC-S-349) Avail: NTIS HC $3.00 CSCL 21H

The propulsion system for the descent stage of the lunar module was designed to provide thrust to transfer the fully loaded lunar module with two crewmen from the lunar parking orbit to the lunar surface. A history of the development of this system is presented. Development was accomplished primarily by ground testing of individual components and by testing the integrated system. Unique features of the descent propulsion system were the deep throttling capability and the use of a lightweight cryogenic helium pressurization system. Author

N73-19878*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: SPACECRAFT PYROTECHNIC SYSTEMS
Mario J. Falbo and Robert L. Robinson Washington Mar. 1973 46 p
(NASA-TN-D-7141; MSC-S-340) Avail: NTIS HC $3.00 CSCL 19A

Pyrotechnic devices were used successfully in many systems of the Apollo spacecraft. The physical and functional characteristics of each device are described. The development, qualification, and performance tests of the devices and the ground-support equipment are discussed briefly. Recommendations for pyrotechnic devices on future space vehicles are given. Author

N73-19879*# Ball Bros. Research Corp., Boulder, Colo.
ASTRONOMICAL OBSERVATORY FOR SHUTTLE. PHASE A STUDY Final Report
D. L. Guthals Jan. 1973 302 p
(Contract NAS9-13094)
(NASA-CR-128841) Avail: NTIS HC $17.25 CSCL 22B

The design, development, and configuration of the astronomical observatory for shuttle are discussed. The characteristics of the one-meter telescope in the spaceborne observatory are described. A variety of basic spectroscopic and image recording instruments and detectors which will permit a large variety of astronomical observations are reported. The study guidelines which defined the components of the observatory are outlined. Author

N73-19880# Committee on Science and Astronautics (U. S. House).
SPACE SHUTTLE - SKYLAB 1973 Status Report
James E. Wilson, Harold A. Gould, and Joseph DelRiego Washington GPO Jan. 1973 101 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 9 Mar. 1973
Avail: Subcomm. on Manned Space Flight.

The status of the space shuttle and Skylab programs is reviewed along with the requirements for shuttle facilities. Based on the briefings and data submitted, the following conclusions are drawn: (1) The technology and fundamental resources exist for the successful development of the earth orbital shuttle. (2) The current shuttle design will allow the development total cost to stay within the $5.15 billion as projected by NASA. (3) For the nation to realize the full benifits of near space in terms of scientific exploration, practical application, and national security, the development of a low cost space shuttle system is essential. F.O.S.

N73-19881*# Grumman Aerospace Corp., Bethpage, N.Y.
A STUDY OF MODAL COUPLING PROCEDURES FOR THE SPACE SHUTTLE
S. Goldenberg and M. Shapiro [1972] 110 p refs
(Contract NAS8-10835)
(NASA-CR-112252) Avail: NTIS HC $7.50 CSCL 22B

Various procedures for analytically coupling two or more substructures to obtain modal data for assembly, using data obtained from mode surveys of the individual components are discussed. Particular attention was paid to the applicability of the techniques investigated to the space shuttle, with the possible replacement of full scale mode surveys of the shuttle assembly by component mode surveys along with analytical coupling. The synthesis procedures formulated in this report can all handle redundant connections, although the presence of redundancies does add complication to one of the techniques. All of the procedures use the test data directly, without going through an intermediate analytical model, and no analytical stiffness data is required to supplement the mode survey data. The coupling precedures were initially verified and evaluated by applying them to analytical check problems. Author

N73-19882*# Lockheed Missiles and Space Co., Palo Alto, Calif.
SPACE SHUTTLE THERMAL SCALE MODELING APPLICATION STUDY Final Report
K. N. Marshall and W. G. Foster Feb. 1973 125 p refs
(Contract NAS9-12991)
(NASA-CR-128849; LMSC-D313907; TP-3613) Avail: NTIS HC $8.25 CSCL 22B

The critical thermal control problems and verification of thermal mathematical model results for the space shuttle concept are discussed. The use of a small scale thermal model of the space shuttle is proposed. It was determined that a one-third scale model of the space shuttle would serve as a useful tool throughout the entire thermal design and verification program. The major considerations in modeling the conduction-radiation-convection fields, the level of detail for modeling various systems, preliminary test requirements, and potential applications of the thermal scale model are summarized. Author

N73-19883*# Martin Marietta Corp., Denver, Colo.
OUTER PLANET ENTRY PROBE SYSTEM STUDY. VOLUME 4: COMMON SATURN/URANUS PROBE STUDIES Final Report
Jan. 1973 239 p refs Prepared for JPL 4 Vol.
(Contracts NAS7-100; JPL-953311)
(NASA-CR-131227) Avail: NTIS HC $14.00 CSCL 22A

Results are summarized of a common scientific probe study to explore the atmospheres of Saturn and Uranus. This was a three-month follow-on effort to the Outer Planet Entry Probe System study. The report presents: (1) a summary, conclusions and recommendations of this study, (2) parametric analysis conducted to support the two system definitions, (3) common Saturn/Uranus probe system definition using the Science Advisory Group's exploratory payload and, (4) common Saturn/Uranus probe system definition using an expanded science complement. Each of the probe system definitions consists of detailed discussions of the mission, science, system and subsystems including telecommunications, data handling, power, pyrotechnics, attitude control, structures, propulsion, thermal control and probe-to-spacecraft integration. References are made to the contents of the first three volumes where it is feasible to do so. Author

N73-19884*# Wisconsin Univ., Madison. Space Science and Engineering Center.
STUDIES OF SOUNDINGS AND IMAGING MEASUREMENTS FROM GEOSTATIONARY SATELLITES Quarterly Report, 1 Nov. 1972 - 31 Jan. 1973
Verner E. Suomi Feb. 1973 31 p
(Contract NAS5-21798)
(NASA-CR-130175) Avail: NTIS HC $3.75 CSCL 22C

Soundings and imaging measurements obtained from geostationary satellites for the period 1 Nov. 1972 to 31 Jan. 1973 are reported. The subjects discussed are: (1) investigation of meteorological data processing techniques, (2) sun glitter, (3) cloud growth rate, and (4) comparative studies in satellite stability. Author

N73-19885*# Ball Bros. Research Corp., Boulder, Colo.
OSO-7 ORBITING SOLAR OBSERVATORY ONE YEAR PERFORMANCE SUMMARY
31 Dec. 1972 89 p
(Contract NAS5-9300)
(NASA-CR-130184; F72-10) Avail: NTIS HC $6.50 CSCL 22C

The performance of the OSO-7 spacecraft during the first twelve months after launch is discussed. A summary description of the spacecraft and experiments is given. Line drawings of the satellite configuration, telemetry subsystem, electronics equipment, pneumatic equipment, and optical equipment are included. Author

N73-19886*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIROS-N SPACECRAFT JITTER CALCULATIONS
G. M. Fleisher Dec. 1972 10 p ref
(NASA-TM-X-66201; X-732-73-51) Avail: NTIS HC $3.00 CSCL 22B

The TIROS-N television infrared observatory system is discussed. The characteristics of the primary payload sensor are presented. The attitude control system jitter specification for satisfactory performance of the sensor is analyzed. The primary sensor is the advanced very high resolution radiometer. The TIROS-N satellite is an orbital platform carrying a number of earth observation sensors. The requirements for three-axis attitude control for proper positioning of the sensors are reported. Author

N73-19887*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SKYLAB 2 SPACE VEHICLE DATA EVALUATION GUIDE
22 Dec. 1972 92 p
(NASA-TM-X-69142; KSC-GP-1001) Avail: NTIS HC $6.75 CSCL 22B

Vehicle telemetry measurements for all stages of Skylab 2 are presented. The data sources for the launch vehicle and command service module are identified. The data evaluation guide format is described. The system for designating the components of the spacecraft is defined. A list of abbreviations for technical terms used in the reporting documents is included. Author

N73-19888*# Sperry Gyroscope Co., Great Neck, N.Y.
NIMBUS D RMP PROGRAM Final Report, May 1967 - May 1970
Nov. 1972 222 p refs
(Contract NAS5-10391)
(NASA-CR-130182; SGD-4222-0569) Avail: NTIS HC $13.25 CSCL 22B

The development of an advanced long life rate measuring package, designed for a five year useful life as a meteorological satellite control sensor is discussed. The primary function of the rate measuring package is to provide rate information for the reaction wheel and gas jet torquing devices that are used to damp spacecraft oscillations and to constrain the spacecraft to the required attitude with respect to the orbital plane. The specifications for the rate measuring package sensor are described. Application of the rate measuring package to the Nimbus D satellite is proposed. Author

N73-19889# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
EUROPEAN SPACE TUG SYSTEM STUDY. PRE-PHASE A STUDY SUMMARY Final Report
Feb. 1971 38 p Prepared jointly with Brit. Aircraft Corp., Construccioneas Aeron., Compagn. Ind. Radioelectrique, Eidgenoess. Flugzeugwerke, Etudes Tech. et Construct. Aerospatiales, Marconi Space and Defense Systems, Selenia, Soc. Natl. Ind. Aerospatiale
(Contract ELDO-CTR-17/4/31)
(MBB-UR-V-38-71-Summary) Avail: NTIS HC $4.00

The results are given of a preliminary study for an unmanned space tug, designed for transferring payloads from low earth orbits to geostationary orbits. The feasibility and economics were determined of a space tug designed for the proposed missions in the equatorial plane from a first analysis of mission interfaces and requirements, operational modes, system requirements and technology implications. The main results are: (1) The proposed space tug is a single stage, reusable tug with propellant mass of 15 tons (LH2-LO2) which has a capability of up to 2 tons in geostationary placement. (2) For larger payloads or more sophisticated missions, an additional kick stage or tandem configuration is required. (3) The concept is a semi-modular one in order to keep flexibility and versatility. (4) The economic comparison between conventional launchers and the shuttle-tug system shows a $5 billion saving for a total of 500 missions until 1990. ESRO

N73-19890# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
EUROPEAN SPACE TUG SYSTEM STUDY. PRE-PHASE A STUDY EXTENSION Final Report
Aug 1971 513 p Prepared jointly with Brit. Aircraft Corp., Construcciones Aeron., Compagn. Ind. Radioelectrique, Eidgenoess. Flugzeugwerke, Etudes Tech. et Construct. Aerospatiales, Marconi Space and Defence Systems, Selenia, Soc. Natl. Ind. Aerospatiale
(Contract ELDO-CTR-17/4/31)
(MBB-UR-V-44-71) Avail: NTIS HC $27.75

An extension of the preliminary definition of a space tug designed for transferring payloads from low earth orbit to geostationary orbit is given. The space concept, the completely modularized concept, and more sophisticated missions, including manned spacecraft and lunar landing, were considered. The results show that the baseline space tug is a single stage with 20 tons of usable propellant mass. The growth capability can be obtained by adding a second stage or a tank module. The ground based operation mode is preferred to the space-based, which appears too complex. Sophisticated missions can be performed by adding special kits to the baseline vehicle. ESRO

N73-19891# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY REPORT
Jan. 1971 304 p Prepared jointly with Soc. l'Air Liquide, Bell Telephone Co., Antwerp, Contraves, Dornier-Werke, ERNO Raumfahrttech., Fiat, Ver. Flugtech. Werke-Fokker, Engins Matra, Montedel-Montecatini Edison Elettronica
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7227) Avail: NTIS HC $17.25

The work carried out by a group of European companies on a preliminary definition of the space tug is summarized. A two-stage reusable space tug of 9.6 tons, all-up mass for each stage, is recommended. This vehicle, which would be ground based, is considered the most suitable for geostationary payload requirements. A preliminary definition of the sub-systems and an evaluation of the total development cost compared with conventional launchers are given. ESRO

N73-19892# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY. PART 2: STUDY DIGEST
1971 110 p
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7264A) Avail: NTIS HC $7.50

The requirements for space tug missions were extended to lunar missions, manned vehicles and in-orbit refuelling. The two-stage earth based tug is still recommended as a baseline for unmanned missions. The optimum all-up mass proposed in view of the new requirements is 12 tons for each stage. Further requirements, e.g. manned missions, can be met by development of the baseline vehicle, orbit based. The effect of these new requirements on sub-systems and total development cost is given. ESRO

N73-19893# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY. APPENDIX 1: STUDY LOGIC AND PLAN
Jan. 1971 31 p
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7227-App-1) Avail: NTIS HC $3.75

The distribution of work packages among the ten European firms participating in the European space tug study, and the scheduling of activities, are presented. ESRO

N73-19894# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY. APPENDIX 2: VEHICLE SELECTION AND ECONOMICS
Jan. 1971 141 p refs
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7227-App-2) Avail: NTIS HC $9.25

Expendable and reusable space tug baseline designs are established at sub-system level based on assumptions and contraints derived from the October 1970 space shuttle data and the mission and payload requirements. A performance analysis was conducted for the possible space tug missions and an overall logistics model was computed which integrated the defined concepts into the transportation system. The reusable tug is shown to be superior to the expendable tug on the basis of program cost and mission feasibility. The inclusion of a tank farm and a number of missions above 20 for the reusable tug are not justified on economic grounds. The reusable tug costs compare well with conventional launcher costs for geosynchronous placement missions. ESRO

N73-19895# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY. APPENDIX 3: PROPELLANT CONTROL AND PROPULSION
Jan. 1971 103 p refs
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7227-App-3) Avail: NTIS HC $7.25

A preliminary study was made of trade-off factors in the propulsion system, insulation system, propellant control systems and pressurization systems, areas which have a strong impact on payload mass. Solutions are indicated for insulation and propellant problems, which keep the costs in a reasonable range. This, however, requires confirmation in development studies. ESRO

N73-19896# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY. APPENDIX 4: GUIDANCE, CONTROL AND RENDEZVOUS
Jan. 1971 165 p refs
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7227-App-4) Avail: NTIS HC $10.25

The feasibility of the tug sub-system which includes attitude control, guidance, and rendezvous is considered. It is concluded that the system could be designed using existing or easily developed equipment. However, further studies are necessary for determination of control parameters, identification of errors and their influence, and verification of potential interface problems between control and overall system dynamics. ESRO

N73-19897# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY. APPENDIX 5: INTEGRATED ELECTRONICS
Jan. 1971 163 p refs
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7227-App-5) Avail: NTIS HC $10.25

The electronic units required for the various subsystems of the space tug are considered. Results are given concerning attitude control, guidance and rendezvous, power, data management, communications, and propulsion. For each subsystem, a statement of requirements is given, which is derived partly from interfaces with other subsystems of the tug, necessary to obtain a viable overall tug system, and partly from known or assumed interfaces with the shuttle and supporting ground stations. An appraisal was made of possible solutions, and one solution has been chosen as a baseline. An estimate of equipment size, and weight and power requirements, was made in order to demonstrate the feasibility of the space tug. Areas requiring further study are indicated. ESRO

N73-19898# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY. APPENDIX 6: STRUCTURE AND CONFIGURATION
Jan. 1971 166 p refs
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7227-App-6) Avail: NTIS HC $10.50

An optimization study was made of the structure and layout of the European space tug, assuming operation in space environment only. Where possible, use was made of existing technology and experience, e.g. the Europa 3 pre-development. Possible load cases and potential materials for the tanks and frame structure are examined. Different configurations are analyzed and optimized. A universal docking system is chosen, capable of docking with other tug stages, various payloads, the space shuttle, the space station, and tank farms. The space tug is compatible with the flight operations of an earth orbiting station and the space shuttle. ESRO

N73-19899# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG. PRE-PHASE A STUDY. APPENDIX 7: WEIGHTS, COST AND DEVELOPMENT PROGRAMME
Jan. 1971 77 p refs
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7227-App-7) Avail: NTIS HC $6.00

Statements made by each participating company in the pre-phase A study of the space tug on the masses of the components and subsystems are tabulated. Test objectives for all the main fields together with the appropriate specimens and rigs are discussed. An economic/logistic analysis was undertaken in order to determine the advantages of the space tug for defined missions compared with alternative means. A preliminary PERT-network is laid out. ESRO

N73-19900# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY, PART 2 Summary Report
Aug. 1971 362 p
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7264) Avail: NTIS HC $20.25

Accomplishments of the pre-phase A continuation study are summarized and conclusions are given which embrace the findings of the initial study. The areas of coverage include: organization, technical planning, technical conclusions, and management conclusions. D.L.G.

N73-19901# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY, PART 2. VOLUME 1: INTRODUCTION, ORGANIZATION, TECHNICAL PLANNING Final Report
Aug. 1971 72 p 6 Vol.
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7264-Vol-1) Avail: NTIS HC $5.75

The objectives of the extension of the pre-phase A study, its logic and Pert network, are given. Alternative concepts of the tug in view of missions other than geostationary placement, such as geosynchronous round-trip missions and earth-based and orbit-based manned missions, are examined. ESRO

N73-19902# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY, PART 2. VOLUME 2: SPECIAL PURPOSE TUG, REFERENCE TUG SYSTEM Final Report
Aug. 1971 85 p refs 6 Vol.
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7264-Vol-2) Avail: NTIS HC $6.25

Requirements for space tug missions were extended from geosynchronous round-trip missions, earth-based, to lunar manned missions, orbit-based, and several tug concepts were examined. The special-purpose concept (two versions) is intended mainly for the primary geosynchronous mission, but is also adaptable to a range of missions and payloads. A multi-purpose tug concept (three versions) for total mission/payload capacity was also examined. Autonomy, modular construction, manned spacecraft, and earth-based or orbit-based options, were included in trade-off studies. These studies show that medium autonomy is to be preferred to maximum autonomy, and integral to modular construction. The 12 ton special-purpose tug could perform all anticipated missions more economically than any of the multi-purpose concepts considered. The special reference tug, earth-based, medium-autonomy, non-man-rated, 12 tons (type A), operational in 1979, could be modified to an earth-based, man-rated version (type B), to an orbit-based version (type C), or to a manned orbit-based version (type D). ESRO

N73-19903# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY, PART 2. VOLUME 3: PROPELLANT AND PROPULSION

Aug. 1971 89 p refs 6 Vol.
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7264-Vol-3) Avail: NTIS HC $6.50

Mass and cost breakdown are given for the 12 ton space tug. Sub-systems related to the propulsion system are examined and include: propellant control in orbit under zero gravity conditions for venting and restart, in-orbit cryogenic propellant transfer, and auxiliary propulsion systems. Trade-off studies were done on the conditions in these areas for modular, earth-based or orbit-based, multi-purpose, or manned options. Reliability is considered. Engine size and characteristics for the different concepts are defined. ESRO

N73-19904# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY, PART 2. VOLUME 4: GUIDANCE, CONTROL, RENDEZVOUS, INTEGRATED ELECTRONICS
Aug. 1971 241 p refs 6 Vol.
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7264-Vol-4) Avail: NTIS HC $14.25

The relationships between the mass and cost of the attitude control and guidance and rendezvous system for the space tug are derived as a function of the tug stage all-up mass for each of the five basic concepts. The effect of basing, degree of autonomy, man-rating, degree of modular breakdown on the operation, cost and mass of the control, guidance and rendezvous system, requirements placed upon the system by each of the multi-purpose concepts, and the resulting masses and costs are discussed. ESRO

N73-19905# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY, PART 2. VOLUME 5: STRUCTURE, CONFIGURATION AND KITS
Aug. 1971 174 p refs 6 Vol.
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7264-Vol-5) Avail: NTIS HC $10.75

A factor analysis was carried out to show the impact on the structural weight and costs of the space tug as a function of the all-up mass, because of increase in the payload capability of the shuttle and changes in missions and requirements. Trade studies were done to show the influence of modularizing orbit-basing, and man-rating the vehicle. Several kits, satellite, auxiliary, and lunar, were investigated to extend the capability of the tug to multi-purpose missions. The additional weight and costs, compared to the baseline 10.4 ton tug, are presented. This information, together with details from other groups, was fed to computer program in order to identify optimum tug versions. Two further studies concerned the use of composite materials for the tug structure and the meteoroid protection problem. The layout of the baseline tug presented in the Part 1 study has not been changed. The all-up mass of the single tug stage has been increased to 12 tons, due to man-rating the tug. ESRO

N73-19906# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG: PRE-PHASE A STUDY, PART 2. VOLUME 6: PERFORMANCE, ECONOMICS, RELIABILITY, WEIGHTS, COSTS AND PROGRAMMES
Aug. 1971 253 p refs 6 Vol.
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7264-Vol-6) Avail: NTIS HC $14.75

The cost and development program of the space tug is reviewed. Satellites and satellite maintenance systems compatible with a space transportation system are outlined. A logistics model for the computerized simulation of the shuttle/tug system in operation is described. Inputs to the computer program are cost and mass data for shuttle and tug, mission parameters and number and masses of payloads. The outputs are the cost of completing a given mission and the payload capacity of a given tug concept. An assessment of the the reliability of the tug is made. ESRO

N73-19907# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
EUROPEAN SPACE TUG. PRE-PHASE A STUDY, PART 1 Executive Summary
1972 82 p
(Contract ELDO-CTR-17/7/44)
(HSD-TP-7316) Avail: NTIS HC $6.25

The results of an extensive performance and cost optimization study for a space tug are summarized. Two major concepts have emerged: the first a single stage with 23 tons of propellant, and the second a two-stage tug with 10 tons of propellant. For each concept, the performance, technology level, mission model capture, fleet size, development cost, unit and operational cost are given. ESRO

N73-19908# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
EUROPEAN SPACE TUG SYSTEM STUDY. PRE-PHASE A STUDY Final Report
Feb. 1971 447 p Prepared jointly with Brit. Aircraft Corp., Construcciones Aeron., Compagn. Ind. Radioelectrique, Eidgenoess. Flugzeugwerke, Etudes Tech. et Construct. Aerospatiales, Marconi Space and Defence Systems, Selenia, Soc. Natl. Ind. Aerospatiale
(Contract ELDO-CTR-17/4/31)
(MBB-UR-V-38-71) Avail: NTIS HC $24.50

The results are given of a preliminary study for an unmanned space tug, designed for transferring payloads from low earth orbits to geostationary orbits. The feasibility and economics were determined of a space tug designed for the proposed missions in the equatorial-plane from a first analysis of mission interfaces and requirements, operational modes, system requirements and technology implications. The proposed space tug is a single stage, reusable tug with propellant mass of 15 tons (LH2-LO2) which has a capability of up to 2 tons in geostationary placement. For larger payloads or more sophisticated missions an additional kick stage or tandem configuration is required. The concept is a semi-modular one in order to keep flexibility and versatility. The economic comparison between conventional launchers and shuttle-tug system shows a $5 billion saving for a total amount of 500 missions until 1990. ESRO

N73-19579* Scientific Translation Service, Santa Barbara, Calif.
LONG-TERM PREDICTION OF THE MOTION OF ARTIFICIAL EARTH SATELLITES IN NEARLY-CIRCULAR ORBITS TAKING ACCOUNT OF AN ARBITRARY NUMBER OF ZONAL HARMONICS
B. V. Kugayenko and P. Ye. Elyasberg *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 143-161 refs (For availability see N73-19572 10-19)
CSCL 22A

N73-19580* Scientific Translation Service, Santa Barbara, Calif.
AERODYNAMIC COMPENSATION FOR THE PERTURBING MOMENTS ACTING ON A SPACECRAFT
B. E. Kashonov *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 162-199 refs (For availability see N73-19572 10-19)
CSCL 22B

N73-19581* Scientific Translation Service, Santa Barbara, Calif.
CONTROL SYSTEMS WITH DISCONTINUOUS LINKS AND WAYS OF OPTIMIZING THEIR CONTROL
L. I. Shatrovskiy *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 200-220 refs (For availability see N73-19572 10-19)
CSCL 22B

N73-19583* Scientific Translation Service, Santa Barbara, Calif.
FORMULATING A MATHEMATICAL MODEL OF CONTROLLED MOTION OF A SPACECRAFT UNDER UNDETERMINED CONDITIONS
Z. N. Mamotko and L. I. Shatrovskiy *In its* Math. Methods of Modeling in Space Res. Mar. 1973 p 254-273 refs (For availability see N73-19572 10-19)
CSCL 22B

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-19909 Politecnico di Milano (Italy). Ist. di Ingegneria Aerospaziale.
AN EXPERIMENTAL METHOD FOR PANEL FLUTTER [UN METODO SPERIMENTALE PER IL FLUTTER DI PANNELLO]
Vittorio Giavotto 1970 21 p refs In ITALIAN
(Publ-90) Copyright. Avail: Issuing Activity

A simple method for the analysis of panel flutter in the static two dimensional mode is presented that separates the structural problems from the aerodynamic problems. The simulation, by analog computer, of the aerodynamic forces, and the advantages of this method are discussed along with the mathematical matrices used to calculate the panel excitation forces. An example of the application of this method using the simulated forces calculated by the piston theory is presented.
Transl. by F.O.S.

N73-19910 Oklahoma Univ., Norman.
DYNAMIC BUCKLING OF AN AXIALLY COMPRESSED CYLINDRICAL SHELL WITH DISCRETE RINGS AND STRINGERS Ph.D. Thesis
Cary Andrew Fisher 1972 134 p
Avail: Univ. Microfilms Order No. 72-23094

The structural response of light aircraft to crash loadings as a basis for crashworthy aircraft design is discussed. The investigation is based on an analysis of the dynamic buckling of discretely stiffened shells. The primary loading is identified as a suddenly applied axial compression loading of short to medium time duration. Appropriate nonlinear strain-displacement relations and equations of motion for the assumed modal shapes were developed. Response curves were plotted in the form of maximum radial deflection as a function of time. Because of the nature of dynamic buckling, the criterion was established that shell buckling occurred when a large increase in radial deflection was observed for a particular loading condition. Dissert. Abstr.

N73-19911*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
ISOGRID DESIGN HANDBOOK
Robert R. Meyer, O. P. Harwood, and J. I. Orlando Feb. 1973 222 p refs
(Contract NAS8-28619)
(NASA-CR-124075; MDC-G4295A) Avail: NTIS HC $13.25 CSCL 13M

A handbook of instructions for the design of isogrid, triangular integral stiffened structures is presented. The basic theory for the analysis of isogrid structures is discussed. Both flanged and unflanged structures are analyzed. The typical design situations for each type of structure are described and methods for optimizing the structure for minimum weight are given where such methods exist. The method of analysis is followed by examples which explain the use of the equations and graphs.
Author

N73-19912# Joint Publications Research Service, Arlington, Va.
SELECTED TRANSLATIONS ON METALLURGY
A. P. Gusenkov, S. V. Serensen, and R. M. Shneyderovich 7 Feb. 1973 39 p refs Transl. into ENGLISH from several Russian publications
(JPRS-58180) Avail: NTIS HC $4.00

Reports are given on properties of diagrams of cyclic deformation at increased temperatures, criteria of breakdown in cyclic elastic-plastic deformation, and resistance to low-cycle deformation and fatigue. For individual titles, see N73-19913 through N73-19915.

N73-19913 Joint Publications Research Service, Arlington, Va.
RESISTANCE TO LOW CYCLE DEFORMATION AND FATIGUE
R. M. Shneyderovich *In its* Selected Transl. on Met. 7 Feb. 1973 p 1-12 refs Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 2, 1971 p 21-27 (For availability see N73-19912 10-32)

Deformation resistance in the homogeneous stress state of composite materials is discussed. The results of the measurement of large deformation fields reveal the kinetics of the deformed state and indicate the criteria of quasi-static and transient failure in the homogeneous stress state. Low-cycle strength tests of machine parts and models constitute an analysis in which the initial cyclic properties of the material produce a calculated estimate of the kinetics of stress, deformation states, and strength. J.M.M.

N73-19914 Joint Publications Research Service, Arlington, Va.
PROPERTIES OF DIAGRAMS OF CYCLIC DEFORMATION AT INCREASED TEMPERATURES
A. P. Gusenkov and R. M. Shneyderovich *In its* Selected Transl. on Met. 7 Feb. 1973 p 13-27 Transl. into ENGLISH from "Soprotivleniye Deformirovaniyu i Razrusheniyu pri Malom Chisle Tsiklov Nagruzheniya" USSR, 1967 p 64-75 (For availability see N73-19912 10-32)

Results of investigations are presented of cyclic deformation properties of austenitic and heat resistant steels occurring at high temperatures. The temperature range of austenitic steels was fixed at a limit of 700 C, and 550 C for that of heat resistant steels. The predominant result of these tests was the derivation of a generalized deformation diagram in the temperature range investigated. It is concluded that this diagram of deformation in relative coordinates exhibits increasingly pronounced strengthening as the temperature increases. J.M.M.

N73-19915 Joint Publications Research Service, Arlington, Va.
FAILURE CRITERIA IN CYCLIC ELASTO-PLASTIC DEFORMATION
S. V. Serensen and R. M. Shneyderovich *In its* Selected Transl. on Met. 7 Feb. 1973 p 28-37 refs Transl. into ENGLISH from "Prochnost, pri Malom Chisle Tsiklov Nagruzheniya" Moscow, Nauka, 1969 p 80-87 (For availability see N73-19912 10-32)

Two types of failure relative to cyclic elasto-plastic deformation were investigated. One is quasi-static in nature if it is caused by the kinetics of uniaxially accumulated deformations, and the other is fatigue in nature if it is caused by the kinetics of stresses during cyclic deformation. Tests reveal that heat resistant steel is characterized by quasi-static failure at all stress levels beyond the proportionality limit, whereas aluminum alloy V-96 undergoes fatigue failure in the presence of identical conditions. J.M.M.

N73-19916# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
HODOGRAPHIC PREDICTION OF CYCLIC CREEP BEHAVIOR
A. Berkovits [1972] 29 p refs
Avail: NTIS HC $3.50

Experimental study of the effect of discontinuous changes in strain-rate on the relationship between strain-rate, strain and stress is described. Data from Udimet 700 in tension at 925 C are used to relate cyclic tensile creep to the monotonic properties of the material by means of the hodograph. The nature of modifications caused to the hodograph by discontinuous variation of the strain-rate is determined from tests. Reloading at discontinuous strain-rate causes reactivation of primary creep. A simple method is proposed for predicting cyclic tensile creep response. Results of cyclic tests agree with predicted response.
Author

N73-19917# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
PREDICTION OF INELASTIC HIGH TEMPERATURE MATERIALS BEHAVIOR BY STRAIN-RATE APPROACH
Avraham Berkovits [1972] 22 p refs
Avail: NTIS HC $3.25

An experimental study of the influence of strain rate on the inelastic properties of well-aged Udimet 700 at 925 C shows a unique relationship between strain rate, strain and stress for this material. This relationship, which is presented graphically in the form of a hodograph, is used to compute material flow behavior under loading histories including stress-strain, creep, stress relaxation, and creep under varying stress. Results obtained compare well with predicted behavior. Author

N73-19918# Lockheed Missiles and Space Co., Palo Alto, Calif.
DISPLACEMENT IN A CYLINDRICAL SHELL SUBJECTED TO A CYLINDRICAL WAVE IN AN ACOUSTIC MEDIUM
V. D. Kubenko [1972] 6 p refs Transl. into ENGLISH from Inzh. Zh., Mekh. Tverd. Tela (USSR), no. 6, 1972 p 67-72

Avail: NTIS HC $3.00; National Translations Center; John Crerar Library, Chicago, Ill. 60616

The numerical analysis of the displacement of a cylindrical shell subjected to a cylindrical wave in an acoustic medium is presented. The cylindrical wave is nonstationary and only inextensible shell vibrations are considered. The wave source is at some finite distance from the shell. It is assumed that the source intensity is uniform over its length with the source axis parallel to the shell axis. Mathematical models are provided to show the relationships based on the equation of inextensible strains of circular hoop shell. Author

N73-19919# National Aerospace Lab., Amsterdam (Netherlands).
FATIGUE DAMAGE ACCUMULATION AND INCOMPATIBLE CRACK FRONT ORIENTATION
J. Schijve 6 Sep. 1972 25 p refs
(NLR-TR-72061-U) Avail: NTIS HC $3.25

Crack propagation tests were performed on 2024-T3 and 7075-T6 specimens. Crack growth was observed under variable amplitude loading during high stress-amplitude cycles associated with 45 deg-mode cracking, with the crack front orientation remaining at an angle of 90 deg. Similarly it was also studied during low stress-amplitude cycles associated with 90 deg-mode cracking with the crack front already at a 45 deg angle. Crack growth curves, fractographic information, and a brief discussion on interaction effects during fatigue damage accumulation are presented. Author

N73-19920# National Aerospace Lab., Amsterdam (Netherlands).
SOME CONTRIBUTIONS OF ELECTRON FRACTOGRAPHY TO THE THEORY OF FRACTURE
D. Broek [1971] 100 p refs
(NLR-TR-72029-U) Avail: NTIS HC $7.00

A survey of accomplishments in the development of electron fractography and the application to the theory of metal fracture are presented. Emphasis is placed on fatigue and ductile fracture of aluminum alloys. Typical fracture features are described for: (1) fatigue striations, (2) slip lines, (3) dimple rupture, (4) intergranular fracture, and cleavage. Author

N73-19921*# Grumman Aerospace Corp., Bethpage, N.Y.
EVALUATION OF LAMINATED ALUMINUM PLATE FOR SHUTTLE APPLICATIONS Final Report
M. J. Martin 8 Mar. 1973 210 p refs
(Contract NAS9-12387)
(NASA-CR-128844) Avail: NTIS HC $12.50 CSCL 11F

Flaw growth behavior in roll diffusion bonded and adhesive bonded 2219-T87 aluminum alloy was compared to that in monolothic 2219-T87. Based on tests at 40 KSI cyclic stress, for equivalent cyclic life, a .004 interlayer laminate can tolerate a surface flaw twice as wide as in monolithic material, or provide an 8% weight saving by operating at higher stress for the same initial flaw. Roll diffusion bonded material with three structural plies of 2219-T87 and two interlayers of 1100 aluminum was prepared with interlayer thicknesses of .004, .007 and .010 in. Total laminate thickness was .130 in. The .004 interlayer laminate was most effective and gave better results than monolithic material at 40 and 48 ksi. Adhesive bonded specimens were fabricated of three sheets of 2219-T87 aluminum alloy bonded with METLBOND 329 adhesive. Adhesive bonded specimens gave longer lives to failure than diffusion bonded specimens at 40 ksi the diffusion bonded material was superior. Flaws initiated in one ply of the laminate grew to the edges of the specimen in that ply but did not propagate into adjacent plies. Author

N73-19922*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STRUCTURAL CONSIDERATIONS IN DESIGN OF LIGHT-WEIGHT GLASS-FIBER COMPOSITE PRESSURE VESSELS
James R. Faddoul 1973 31 p refs Proposed for Presentation at Intern. Conf. on Pressure Vessel Technol., San Antonio, 1-4 Oct. 1973; sponsored by ASME
(NASA-TM-X-68198; E-7359) Avail: NTIS HC $3.75 CSCL 13D

The development of structurally efficient, metal-lined, glass-fiber composite pressure vessels. Both the current state-of-the-art and current problems are discussed along with fracture mechanics considerations for the metal liner. The design concepts used for metal-lined, glass-fiber, composite pressure vessels are described and the structural characteristics of the composite designs are compared with each other and with homogeneous metal pressure vessels. Specific design techniques and available design data are identified. Results of a current program to evaluate flaw growth and fracture characteristics of the metal liners are reviewed and the impact of these results on composite pressure vessel designs is discussed. Author

N73-19923*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FILAMENT-WOUND COMPOSITE VESSELS MATERIAL TECHNOLOGY
R. F. Lark 1973 22 p refs Proposed for Presentation at the 2d Intern. Conf. on Pressure Vessel Technol., San Antonio, 1-4 Oct. 1973; sponsored by ASME
(NASA-TM-X-68196; E-7357) Avail: NTIS HC $3.25 CSCL 13D

Programs are reviewed that were conducted to establish a technology base for applying advanced fibers or resins to high performance filament-wound pressure vessels for containment of cryogens and high pressure gases. Materials evaluated included boron, graphite, PRD 49-1 and 3/epoxy and S-glass/polyimide composites. Closed-end cylindrical, and oblate spheroid-shaped vessels were fabricated in 4- and 8-inch diameter sizes. Vessels were subjected to single-cycle burst, low-cycle fatigue, and sustained loading tests over a -423 F to room temperature range for epoxy composites and a -423 to 500 F temperature range for the polyimide composites. Vessels tested at cryogenic and/or 500 F had thin (3 to 20 mils) metallic liners whereas vessels tested at room temperature had elastomeric liners. Correlations between acoustic emissions and burst and cyclic properties of PRD 49-1 filament-wound vessels are discussed. Author

N73-19924*# Carnegie-Mellon Univ., Pittsburgh, Pa.
FINITE DEFORMATION OF ELASTO-PLASTIC SOLIDS
J. R. Osias Washington NASA Mar. 1973 174 p refs
(Grant NGL-39-002-023)
(NASA-CR-2199; SM-72-22) Avail: NTIS HC $3.00 CSCL 20K

A theoretical basis is established for analysis of finite deformation of metals. The observation that finite deformation of such elastoplastic materials may be viewed as a process rather than an event leads to derivation of a complete initial and boundary value problem distinguished by its quasilinear nature. This feature of the formulation motivates adoption of an incremental approach to numerical problem solving. Numerical solution capability is established for problems of plane stress and plane strain. The validity of the theory and numerical analysis is demonstrated by consideration of a number of problems of homogeneous finite deformation for which analytic solutions are available. Subsequently the analysis is employed for the investigation of necking in flat metal tensile bars. The results of this investigation provide the first full numerical solutions for tensile necking in plane stress and plane strain. In addition a basis is provided for assessment of the validity of stress-strain relations inferred from tensile test data. Author

N73-19925# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
BOUNDING THE LIFE OF STRUCTURES SUBJECTED TO STEADY LOAD AND OPERATING WITHIN THE CREEP RANGE
I. W. Goodall and R. D. H. Cockroft Feb. 1972 34 p refs
(RD/B/N-2257) Avail: AEC Depository Libraries

A simplified life assessment is offered for structures nominally subjected to constant load and operating within the creep range. It is shown that the life of any structure subjected to conditions where creep occurs may be bounded by two simple procedures. In the particular case where the plastic yield surface is similar to the isochronous creep failure surface, the upper bound on life is obtained simply from a knowledge of the plastic collapse load. The lower bound approach requires a knowledge of the stationary state stress distribution. It was argued that the actual time of failure relative to these bounds is governed by a material property rather than the geometry of the structure. The bounds on life were applied to some simple structures where a more complete analysis or experimental data are available. It is

shown that an upper bound solution gives a close approximation to the life of a structure provided that there is adequate ductility. Author

N73-19926# Brown Univ., Providence, R.I. Div. of Engineering.
CRACK TIP PLASTICITY AND FRACTURE INITIATION CRITERIA
J. R. Rice Aug. 1972 6 p refs
(Contract AT(11-1)-3084)
(COO-3084-16; TR-16) Avail: NTIS

Fracture initiation from the tips of macroscopic precracks in structural metals was studied under plane-strain-like conditions at the crack front. The work of Rice and Johnson is followed in interpretation of fracture mechanisms, and for developing fracture initiation criteria. Plain-stress elastic-plastic crack tip stress fields and cleavage microcracking are discussed along with ductile void growth and coalescence. F.O.S.

N73-19927# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
CALCULATION OF THE 1:5 THTR CONTAINER MODEL [ZUR BERECHNUNG DES 1:5 THTR BEHAELTERMODELLS]
P. Warnke and K. J. William Jul. 1972 65 p refs In GERMAN
Sponsored by Bundesmin. fuer Bildung und Wiss.
(ISd-120) Avail: NTIS HC $5.25

A linear computation, based on the finite element method, is presented of a 1:5 high temperature reactor pressure vessel scale model under stress with an internal pressure of 30 kmp/sq cm. The following five problems have been treated:(1) three-dimensional calculation of a 30 deg sector, taking into account main openings for cooling fans and heat exchangers; (2) axially symmetrical calculation of the vessel without consideration of openings and irregularities in the circumference; (3) two-dimensional calculation of a 45 deg sector as a horizontal cross section through the middle of the vessel wall; (4) calculation of a control rod opening of the floor by means of three-dimensional and cylinder symmetrical considerations; and (5) comparison of the results with results from measurements of the model. ESRO

N73-19928# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Manufacturing Research and Product Development Dept.
MIXED STRUCTURE STUDY FOR CARGO DOOR OF SPACE SHUTTLE ORBITER
F. J. A. M. DeBebeer, J. J. Cools, L. M. Godfried, and R. Struyck
12 Jun. 1972 142 p refs
(Contract ELDO-CTR-17/5/35-21047)
(R-1525) Avail: NTIS HC $9.25

The feasibility of a mixed structure, consisting of boron/polyimide composite material laminated between titanium sheets, was investigated for the cargo door of the orbiter. The technical results concerning evaluation and testing of materials as design, manufacturing and testing of a typical door structure are presented. ESRO

N73-19929# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
STRESS ANALYSIS OF AN ADHESIVE LAP JOINT SUBJECTED TO TENSION, SHEAR FORCE AND BENDING MOMENTS
Murlidhar H. Pahoja Aug. 1972 169 p refs
(Contract N00019-72-C-0274)
(AD-753469; T/AM-361; UILU-ENG-72-6009) Avail: NTIS CSCL 13/5

A stress analysis of the lap joint is presented treating the problem as one of plane strain. The joint is subjected to a general loading, consisting of tension, shear force and bending moments. The variation in the material properties and thickness of the two adherends is considered. The displacement field in the adhesive layer is expressed in series form and the compatibility condition at the interface is used to express the displacement field in the adherends. The potential energy of the joint is calculated and minimized to obtain linear, ordinary differential equations and boundary conditions. The differential equations are solved on the computer. Author (GRA)

N73-19930# Army Construction Engineering Research Lab., Champaign, Ill.
CREEP CHARACTERISTICS OF POLYESTER CONCRETES
P. A. Howdyshell Nov. 1972 21 p refs
(AD-752454; CERL-TR-M-23) Avail: NTIS CSCL 13/3

The purpose of the project was to determine the nature, magnitude, and factors influencing the creep of particle-filled polyesters, and to what extent creep affects the usefulness of the material in concrete-type applications. Tests were conducted on an aggregate- and a cement particulate-filled polyester to determine compressive creep characteristics. The evaluation consisted of using laboratory test techniques that directly relate to the evaluation of creep in portland cement concrete. Author (GRA)

N73-19931# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
STABILITY CRITERIA FOR ELASTIC MATERIALS
K. N. Sawyers and R. S. Rivlin Dec. 1972 23 p refs
(Contract N00014-67-A-0370-0001)
(AD-753459; CAM-100-16) Avail: NTIS CSCL 20/11

Conditions are derived which are necessary for stability of incompressible elastic materials. These are obtained by considering small shearing displacements superimposed on a finitely deformed state of the material. Author (GRA)

N73-19932# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF A THREE-DIMENSIONAL STRESS ANALYSIS PROGRAM M.S. Thesis
Charles Gregory Pfeifer Sep. 1972 90 p refs
(AD-753617) Avail: NTIS CSCL 20/11

The objective of this work was to analyze an IBM 360 FORTRAN computer program using three dimensional quadratic isoparametric finite elements for structural analysis. Three problems with classical solutions were run with various mesh sizes using the computer program being tested. The data computed was then extensively analyzed and compared with the classical solutions. The analysis of a fourth problem was continued and compared with results obtained in an earlier project. Author (GRA)

N73-19933# Watervliet Arsenal, N.Y.
FACTORS OF STRESS CONCENTRATION AT A HOLE IN FINITE STRIPS UNDER BENDING
Yean Fu. Cheng Aug. 1972 17 p refs
(DA Proj. 1T0-62105-A-349)
(AD-753574; WVT-7240) Avail: NTIS CSCL 20/11

Factors of stress concentration were determined, experimentally and analytically, for isotropic finite strips containing a hole under in-plane bending. The hole-diameter to strip-width ratio (D/W) is between 1/16 and 7/8. Photoelasticity was used as the experimental method and the NASTRAN finite element as the analytical approach. The results extend Frocht and Leven's information, which was limited to $D/W = or < /3$. Author (GRA)

N73-19934# Aerospace Corp., El Segundo, Calif. Aerodynamic and Propulsion Research Lab.
ELASTIC WAVE PROPAGATION IN A POROUS LAMINATED COMPOSITE Final Report, Feb. - Jul. 1972
Charles Sve 28 Dec. 1972 41 p refs
(Contract F04701-72-C-0073)
(AD-753900; TR-0073(3240-30)-1; SAMSO-TR-72-301) Avail: NTIS CSCL 11/4

An analysis is presented for linear elastic wave propagation normal to the laminations of a periodically laminated porous composite. The porosity is randomly distributed throughout one constituent and is composed of small spherical voids. This type of porosity is called randomly periodic and produces Rayleigh scattering where the wavelength of the incident wave is much larger than the void diameter. Porosity also reduces the wave speed in a constituent and thereby affects geometric dispersion. A dissipative equation of motion is developed for porous material that includes a porosity-dependent wave speed and a scattering term that provides spatial attenuation. This equation is then used for a constituent of a composite, and a dispersion relation and pulse solution are obtained to determine the significance of porosity in a laminated composite. Author (GRA)

N73-19935# Air Force Armament Lab., Eglin AFB, Fla.
THE ELASTIC PLASTIC RESPONSE OF LONG SLENDER RODS SUBJECTED TO IMPULSIVE TYPE LOADINGS Final Report, Jan. 1971 - May 1972
Massey B. Valentine and Gerald D. Whitehouse Jun. 1972 141 p refs
(AD-754241; AFATL-TR-72-124) Avail: NTIS CSCL 20/11

Experimental and analytical results are presented for the elastic plastic deformation of a slender rod subjected to impulsive loading that occurs during the impact of a rod against a rigid plate. Particular emphasis is given to the lateral or flexure buckling mode shapes that occur during the impact. The transient response and resulting deformation were recorded with the aid of high speed photography and flash X-rays. A frame-by-frame record of the impact phenomena gives the displacement of a particle on the rod and the plastic wave propagation position. Also presented are three distinct failure modes that result, dependent primarily upon impact geometry. Author (GRA)

N73-19936# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
FRACTURE MECHANICS IN GENERALIZED ELASTIC THEORY, IN THE PRESENCE OF HIGH STRAIN GRADIENT AND IN THE PRESENCE OF ELASTIC INCLUSION
Y. C. Hsu and F. D. Ju Nov. 1972 25 p
(Grant AF-AFOSR-2135-71; AF Proj. 9782)
(AD-754211; ME-59(72)AFOSR-198; AFOSR-73-0014TR)
Avail: NTIS CSCL 20/11

The stress intensity factor is proposed based on the solutions that generate fractional power singularities. This factor is a generalization of the Irwin-Griffith factor. Couple-stresses solutions are obtained for an infinite tension elastic plate bounded at the interior by an elliptical hole with the static equilibrating tractions. The normal tension in the plate is uniform along the minor axes. The selection of the Mathieus' functions and the form of weighting functions in the boundary conditions match a particular class of boundary values which reduces upon limiting processes to three special cases. Based on the two-dimensional theory of elasticity and Muskhelishvilli technique, the effect of a circular inclusion of different elastic material on the stress state around (1) two collinear finite cracks in an infinite plate under uniform stresses at infinity, and (2) a finite line crack subject to the concentrated forces applied to the crack surface in a plate. Author (GRA)

N73-19937# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
THE EFFECT OF A CIRCULAR INCLUSION ON THE STRESS INTENSITY FACTORS AROUND A LINE CRACK UNDER THE CONCENTRATED FORCES
Y. C. Hsu, C. Y. Huang, and F. D. Ju Oct. 1972 27 p refs
(Grant AF-AFOSR-2135-71; AF Proj. 9782)
(AD-754210; ME-58(72)AFOSR-74; AFOSR-73-0012TR) Avail: NTIS CSCL 20/11

The investigation aims at the fracture stability (toughness) of the flat large elastic cracked plate in the presence of an elastic circular inclusion. To this end, the crack-tip stress intensity factor for plane problems, K, in the field theory of elastic fracture, is proposed as a criterion for the fracture stability. Here K is defined as the magnitude of stresses in the vicinity of the end of the crack and determines the onset of rapid fracture in the elastic theory of Griffith-Irwin. Of interest is K in a flat large elastic plate with a finite line crack under the concentrated forces applied to the crack surface containing an elastic circular inclusion. The analysis is based on the two-dimensional theory of elasticity and by use of the Muskhelishvilli complex variable approach. K varies with the configuration and elastic properties of the plate and the inclusion. Solutions obtained can be reduced to special cases: (1) the homogeneous plate with a line crack, (2) the plate with a hole and a line crack, and (3) the plate with a rigid inclusion and a line crack. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-19938 + North Carolina State Univ., Raleigh.
STRUCTURE-PROPERTY RELATIONSHIPS IN HEAT PIPE WICKING MATERIALS Ph.D. Thesis
Ernest George Alexander, Jr. 1972 131 p
Avail: NTIS Avail: Univ. Microfilms Order No. 72-24068

Structure-property relationships in several classes of heat pipe wicking materials have been studied. The properties of porous media that determine performance as heat pipe wicks (permeability, equilibrium capillary height, and effective thermal conductivity) of materials from each class have been determined experimentally. These properties were correlated with structural properties (material of construction, particle shape, particle size, pore size, and porosity). Thus, using the results of this study, it is possible to predict the properties of a porous medium that determine its performance as a heat pipe wick when the structural properties of the wick are known. A simplified analytical model based on appropriate mass, energy, and momentum balances that enables prediction of the critical heat flux of a capillary limited heat pipe is presented and shown to be in excellent agreement with experimental results. Dissert. Abstr.

N73-19939 Utah Univ., Salt Lake City.
FLAME SPECTRA OF SOLID PROPELLANTS DURING UNSTABLE COMBUSTION Ph.D. Thesis
John Lincoln Eisel 1972 206 p
Avail: Univ. Microfilms Order No. 72-23599

A program was undertaken to observe spectral details of the flames of composite solid propellants during unstable combustion in an attempt to further elucidate the processes involved. This program was motivated by the inconsistencies between experimental observations of burning solid propellants and theoretical modeling of the same, particularly in the area of unstable combustion. In order to accomplish this end a rapid-scanning optical spectrometer was employed which was capable of up to 800 scans per second. Use of this system allowed measurements of temperature and composition relative to chamber pressure. From these measurements phase and time differences were determined. At least three different varieties of unstable combustion were observed; sometimes simultaneously. These are described as bulk mode instability, layer frequency instability, and local intrinsic instability. Dissert. Abstr.

N73-19940*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STUDY OF HIGH ALTITUDE PLUME IMPINGEMENT Final Report
J. V. McAnally and S. D. Smith Jan. 1973 67 p refs
(Contract NAS8-28057)
(NASA-CR-124093; LMSC/HREC-TR-D306389; HREC-8057-1)
Avail: NTIS HC $5.50 CSCL 20M

The radiation intensities are determined in the base region of the space shuttle due to solid particle radiation emanating from the solid rocket motors of the shuttle. Results of an analysis of the Titan 3 and simulated solid rocket motor radiation intensities are presented. The gas particle flow fields of the Titan 3 nozzle and plume and a space shuttle solid rocket motor nozzle and plume are described. The gaseous Titan 3 flow fields are discussed utilizing the results of flow fields generated by a gaseous and two phase method-of-characteristics computer program. A two phase computer flow field analysis program was developed. An outflow correction theory is developed which will be used to modify existing convection heat transfer methods for better heat transfer predictions on bodies immersed in rocket exhaust plumes. Author

N73-19941# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFLUENCE OF SURFACE MICROSTRUCTURE ON THE EVOLUTION AND FUNCTION OF COMBUSTION VELOCITY

OF SOLID COMPOSITE PROPELLANTS [INFLUENCE DE LA MICROSTRUCTURE DE SURFACE SUR L'EVOLUTION EN FONCTION DE LA PRESSION DE LA VITESSE DE COMBUSTION DES PROPERGOLS SOLIDES COMPOSITES]
Guy Lengelle, Jean Brulard, and Franck Ferrie 1972 20 p refs In FRENCH; ENGLISH summary Presented at Colloq. sur la Chim. Phys. de la Combustion, Poitiers, France, 26-27 Oct. 1972
(ONERA-TP-1167) Avail: NTIS HC $3.00

Some aspects of the mechanisms which control the evolution of combustion velocity of solid composite propellants, based on ammonium perchlorate (A.P.) as a function of pressure, are presented. It is well-known that the model of Summerfield, assuming that the combustion velocity is limited at high pressure by the diffusion of oxydizing and combustible gases into one another, explains this evolution. However there are limits in the application of the model A.P. regarding the particle size and the content of A.P. The nature of the binder enters as well, in particular in the occurrence of the plateau effect. The structure of the propellant surface is important with respect to this phenomenon. Scanning electron microscope observation, after quenching of the combustion, seems to reveal the influence of the difference between the thermal stabilities of A.P. and the binder. The linear pyrolysis technique, with a heating element or by exposure in a hot gas jet, enables a quantitative characterization of thermal stability in the propellant components. Author

N73-19942# Defence Research Establishment Valcartier (Quebec).
ILLUMINANCE MEASUREMENTS OF AIRBORNE FLARES CFB COLD LAKE 1970
D. Pleiter Aug. 1972 81 p refs
(DREV-R-673/72) Avail: NTIS HC $6.25

During tests of two types of flares simultaneous recordings were made of the ground illuminance at two separate locations. In the case of 11 flares of the first type and 4 of the second, effective values of the luminous intensity were obtained by combining the illuminance measurements with theodolite measurements of flare position. The effective values ranged from 10 to 20 percent lower than the intensities ascribed to the flares. In addition, some subjective observations were made of the spectra of the flares and of tactical scenes viewed through a low-light-level television system. Author

N73-19943# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
SOOT OXIDATION KINETICS AT COMBUSTION TEMPERATURES
John Appleton 1973 11 p refs Presented at AGARD Propulsion and Energetics Panel 41st Meeting on Atmospheric Pollution by Aircraft Engines, London, 9-13 Apr. 1973
(Grant NSF GK-33933)
Avail: NTIS HC $3.00

Comparisons between soot oxidation in laboratory flames and in shock tubes were made with previously obtained measurements of the surface oxidation rate of bulk samples of pyrolytic graphite. It was determined that the surface oxidation rate mechanism for soot and pyrolytic graphite are the same and that the rates may be predicted by a semi-empirical expression, which expresses the specific surface oxidation rate in terms of the surface temperature and the gas-phase partial pressure of oxygen. This expression provides a method for estimating soot oxidation rates which is suitable for use in engineering design and performance studies of most practical combustion systems. Author

N73-19944# Akron Univ., Ohio. Dept. of Mechanical Engineering.
UNSTEADY HEAT CONDUCTION IN A SLAB WITH INTERNAL HEAT SOURCES AND RADIATIVE BOUNDARY CONDITIONS
Benjamin T. F. Chung and L. T. Yeh 2 Nov. 1972 39 p refs Backup document for AIAA Synoptic, "Heat Conduction in Slabs with Internal Heat Sources and Radiative Boundary Conditions," scheduled for publication in Journal of Spacecraft and Rockets in Jul. 1973
Avail: NTIS HC $4.00

A finite difference technique to determine the transient temperature distribution in a plane slab, having uniform heat sources and radiative boundary conditions is explained. The solid has a uniform initial temperature and the heat conduction is one-dimensional. Results to computations are presented in extensive dimensionless charts over a wide range of physical parameters. These charts are useful both for direct application and as a testing ground for approximate schemes. Closed form asymptotic short time solutions at the radiative surface and isothermal solutions are obtained. These formulations permit the calculation of temperatures which are not covered by the charts. Comparisons are made between the present results and the approximate solutions based on the variational method. The effect of variable properties on the temperature distribution of the slab is also investigated. Author

N73-19945*# Linguistic Systems, Inc., Cambridge, Mass.
INVESTIGATION OF THE STRUCTURE OF DIFFUSION HYDROGEN FLAMES
R. S. Tyulpanov, V. F. Sokolenko, and A. I. Alimpiev Washington NASA Mar. 1973 9 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk) p 318-321
(Contract NASw-2482)
(NASA-TT-F-14842) Avail: NTIS HC $3.00 CSCL 21B

The structure of diffusion hydrogen flames is studied by the Topler method. They established that burning in a diffusion flame takes place in local zones, which is connected with the structure of turbulence. Author

N73-19946*# Linguistic Systems, Inc., Cambridge, Mass.
THE STRUCTURE OF DIFFUSION FLAMES
V. F. Sokolenko, R. S. Tyulpanov, and Yu. V. Ignatenko Washington NASA Mar. 1973 12 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), no. 4, 1971 p 566-571
(Contract NASw-2482)
(NASA-TT-F-14843) Avail: NTIS HC $3.00 CSCL 21B

A technique, used for treatment of instantaneous Topler schlieren pictures in a study of the diffusion flame structure of plane hydrogen jets in laminar hydrogen-air flows in a rectangular 45 x 45-mm channel with vortex generators, is described. Temperature inhomogeneity scales vs initial flow rates and hydrogen-air ratios were determined for the diffusion burning of hydrogen-air flows. Author

N73-19947# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
EMISSION CHARACTERISTICS OF AN AIRCRAFT AUXILIARY POWER UNIT
F. W. Penn and W. F. Marshall 1973 16 p Sponsored in part by EPA
(BM-RI-7735) Avail: NTIS HC $3.00

An aircraft auxiliary power unit (APU) was used as an exhaust source for evaluation and refinement of sampling and analytical procedures for gas turbine engines. The unit was also used to determine the emission characteristics of APU's in service and to study the effect of fuel composition and combustor design on exhaust emissions. Carbon monoxide, carbon dioxide, oxides of nitrogen, hydrocarbons, aldehydes, particulate loading, and odor were measured at engine operating modes representing the duty cycle encountered in airline operation. Analyses showed good repeatability, and adequate sensitivity was attained in these experiments. Smoke opacity measurements were not taken owing to the lack of a high-sensitivity smokemeter. Results showed that the minimum emission levels occurred with the standard combustor and jet A fuel. Emission rates were highly dependent on test mode, but emission patterns as a function of test mode were similar for all fuels and combustors tested. A comparison of three identical design production combustors showed a variation in average emission rates of less than 5 percent. Author

N73-19948# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.
THE FIRE WHIRL: THEORY AND EXPERIMENT
Robert Mayle Feb. 1973 46 p refs
(Grant NSF GK-10314)
(TR-5) Avail: NTIS HC $4.50 CSCL 21B

The characteristics of a rising, rotating column of gases, called a plume or fire whirl, are presented. A quasi-one dimensional theory for the plume, which includes the effect of pressure forces on the plume caused by the ambient rotation, is

described. The flow field generated by a fire whirl is considered as a composite of three flow regions, each coupled to one another by interfacial conditions. The three regions are: (1) free vortex flow outside the plume, centered on the fuel source with its axis normal to the ground, (2) a vertical, vorticity bearing, rising convection plume above the fuel source, and (3) a ground boundary layer with a flow driven in toward the fuel source by the pressure forces impressed on it as a result of the vortex motion above.
Author

N73-19949*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF PREVAPORIZED FUEL ON EXHAUST EMISSIONS OF AN EXPERIMENTAL GAS TURBINE COMBUSTOR
Carl T. Norgren and Robert D. Ingebo 1973 25 p refs Presented at Spring Meeting of the Central States Sect. of the Combust. Inst., Urbana, Ill., 27-28 Mar. 1973
(NASA-TM-X-68194; E-7336) Avail: NTIS HC $3.25 CSCL 21B

Effects of fuel vaporization on the exhaust emission levels of oxides of nitrogen (NOX), carbon monoxide, total hydrocarbons, and smoke number were obtained in an experimental turbojet combustor segment. Two fuel injector types were used in which liquid ASTM A-1 jet fuel and vapor propane fuel were independently controlled to simulate varying degrees of vaporization. Tests were conducted over a range of inlet-air temperatures from 478 to 700 K (860 to 1260 R), pressures from 4 to 20 atmospheres, and combustor reference velocities from 15.3 to 27.4 m/sec (50 to 90 ft/sec). Converting from liquid to complete vapor fuel resulted in NOX reductions as much as 22 percent and smoke number reductions up to 51 percent. Author

N73-19950# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
HEAT TRANSFER FROM A RADIOISOTOPE GENERATOR, USING ORGANIC FLUIDS
J. C. Cavoret, P. Lavigne, and A. Teytu [1972] 6 p refs in FRENCH; ENGLISH summary Presented at 12th Meeting on Hydraulics, Paris, 6 Jun. 1972
(CEA-CONF-2042; Conf-720648-12) Avail: AEC Depository Libraries

An organic fluid is used to transfer heat from the cobalt-60 source to the converter boiler of a radioisotope source generator with an output of about 100W. The turbine converter operates with an organic working fluid. The generator, its thermal characteristics, and the safety systems associated are described.
NSA

N73-19951# Union Carbide Corp., Tonawanda, N.Y. Linde Div.
EVALUATION OF A MOLYBDENUM FOIL - ZIRCONIA CLOTH INSULATION SYSTEM AFTER 10,000 HOURS AT A SOURCE TEMPERATURE OF UP TO 1100 C (2012 F)
D. J. Caffarelli and R. Zawierucha Sep. 1972 64 p refs
(Contract AT(29-2)-2832)
(ALO-2832-45) Avail: NTIS

Results of the molybdenum foil - zirconia cloth insulation system stability tests are reported. The test and post-test analyses were performed from Nov. 1970 to Aug. 1972. The objectives of this program are to evaluate and demonstrate long-term thermal performance stability of multi-layer insulations at source temperatures up to 1100 C for use in radioisotope power systems. The test system was maintained at stability test conditions for 10,000 hours. Upon completion of this test duration the system was disassembled for post test analysis. The results of the ensuing evaluation are documented. Author (NSA)

N73-19952# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
CALCULATION OF THE AERODYNAMIC HEATING OF THE EUROPA 3 LAUNCHER
Mar. 1972 73 p refs
(Contract ELDO-CTR-17/4/47)
(TN-ER/02-22/001) Avail: NTIS HC $5.75

The inviscid flow field around the Europa 3 launch vehicle during the first stage trajectory was calculated by the method of characteristics with the computer program CHARAKT developed for three dimensional flow fields. The data obtained (pressure coefficients) were used for subsequent calculation of aerodynamic heating. The heat flux caused by aerodynamic heating was then calculated with the computer program QUAERO. Heat transfer at stagnation point was also calculated with the computer program AERHEAT. Author (ESRO)

N73-19953# Fiat S.p.A., Turin (Italy). Aviation Div.
INVESTIGATION OF NON METALLIC THERMAL PROTECTION PANELS Final Report
12 Jul. 1972 128 p refs
(Contract ELDO-CTR-17/6/58)
(TASS-72-Z-1095) Avail: NTIS HC $8.50

Theoretical investigations were carried out to define guidelines for the selection of suitable thermal protection materials. A mathematical model was established in order to correlate known thermophysical properties of materials with thermal protection weight for the assigned mission. As a result, zirconium oxide components in the form of mats were selected for experimental research. Rigid samples were constructed which show promising properties and a coating compatible with the system was selected.
ESRO

N73-19954# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
A PROBABILISTIC APPROACH TO THE DESIGN OF HEAT PIPES
C. C. Roberts and K. T. Feldman Sep. 1972 211 p refs
(Contract N00014-68-A-0155-0002)
(AD-752057; ME-55(72)ONR-012) Avail: NTIS CSCL 13/1

The design of heat pipes involves knowledge of phenomena such as surface tension forces, wick permeability, and fluid vaporization and condensation. Considerable variability in these phenomena has been observed in heat pipe experiments. Thus, a probabilistic design model for predicting heat pipe heat transfer rate was developed taking into consideration uncertainty in the prediction of the above phenomena. The probabilistic model yields a mean, a standard deviation, and the distribution of heat transfer rate based on the means, standard deviations, and distributions of the design parameters. The probabilistic method is compared to experimental data from heat pipes with wire mesh wicks. Mean values, standard deviations, and distributions are presented for wick permeability, critical radius, area, porosity, tortuosity, and heat transfer rate. A technique is described for making wire mesh wicks. The probabilistic design model indicates the range of design without the use of safety factors. Author (GRA)

N73-19955# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
MODE TRANSITION IN INTEGRAL RAMJET ROCKET PROPULSION SYSTEMS
William G. Beecroft and Russell E. Petersen Oct. 1972 66 p refs
(AF Proj. 3012)
(AD-753904; AFAPL-TR-72-50) Avail: NTIS CSCL 21/2

An analytical study of mode transition in the integral ramjet-rocket class of propulsion system was conducted. A baseline design was selected and used for analysis. The several factors affecting the engine aerothermodynamic performance during mode transition were evaluated. A quantitative evaluation method was established to aid in design of future engines of this class. Specific developmental recommendations are made.
Author (GRA)

N73-19956# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
DIRECT MIXING AND COMBUSTION MEASUREMENTS IN DUCTED, PARTICLE-LADEN JETS
Steven W. Abbott, L. Douglas Smoot, and Klaus Schadow (Naval Weapons Center, China Lake, Calif.) 1 Dec. 1972 14 p refs Presented at AIAA/SAE 8th Joint Propulsion Specialist Conf., New Orleans, 29 Nov. - 1 Dec. 1972 Submitted for publication
(Contract N00014-70-A-0074-0002; NR Proj. 094-365)
(AD-754434; BYU-TR-015-3; AIAA-Paper-72-1177) Avail: NTIS CSCL 21/9

Using water-cooled probes and hot-gas valves, gas-particle samples were withdrawn from the secondary duct of an air-augmented laboratory burner. Using a boron-loaded propellant,

air/fuel ratio and secondary duct pressure were varied from 12/1 to 32/1 and from 82 to 127 psia respectively. From sample analysis of chlorine, argon (air tracer), boron, and boron oxide, radial and axial profiles of air, gaseous fuel, particulate fuel and percent of boron combustion were determined. Particles and gases were mixed at significantly different rates. Measured gas-phase mixing rates were more rapid than model predictions, which assumed particles to be in equilibrium with gases. Boron combustion efficiency varied markedly with duct position, air/fuel ratio and secondary chamber pressure. Author (GRA)

N73-19957# Army Foreign Science and Technology Center, Charlottesville, Va.
APPLICATION OF THE METHOD OF POWER SERIES TO THE SOLUTION OF AN INHOMOGENEOUS EQUATION OF HEAT CONDUCTIVITY
L. F. Vozyuk and Yu. T. Krivenchuk 22 Jun. 1972 8 p refs Transl. into ENGLISH from Mat. Fiz. (Kiev), no. 7, 1970 p 45 (AD-754256; FSTC-HT-23-796-72) Avail: NTIS CSCL 20/13

The paper discusses a solution to the heat conductivity problem of a body having variable density and specific thermal conductivity. The Laplace transform is applied to reduce this problem to a solution of an ordinary differential equation by the method of power series. An example is given to demonstrate the efficiency of this method. Author (GRA)

N73-19807 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
A CALCULATION METHOD FOR THE EXTERNAL HEAT TRANSFER TO TURBINE BLADES
D. K. Hennecke *In* AGARD Boundary Layer Effects in Turbomachines Dec. 1972 p 261-273 refs (For availability see N73-19794 10-28)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-19958*# National Academy of Public Administration, Washington, D.C.
NASA SEMINAR ON ORGANIZATION AND MANAGEMENT
R. W. Crawley and E. H. Kloman Aug. 1972 71 p refs (Contract NSR-09-046-001)
(NASA-CR-131087) ,Avail: NTIS HC $5.75 CSCL 05A

The proceedings of a seminar series of current problems and organization of NASA are presented. The seminar was designed to provide a comparative basis for understanding such recurring problems as delegation of authority; resource allocation and decision making patterns; headquarters organization; systems of program control and evaluation; roles and relations of scientists, engineers, and administrators; headquarters-field center relationships; and the overall management philosophy of the headquarters and field centers. Author

N73-19959# Advisory Group for Aerospace Research and Development, Paris (France).
AIR TO GROUND TARGET ACQUISITION
Nov. 1972 170 p refs Presented at AGARD Aerospace Med. Panel Specialist Meeting, Brussels, Belgium, 31 May - 1 Jun. 1972
(AGARD-CP-100) Avail: NTIS HC $10.50

The fifteen papers and ensuing discussions presented at the AGARD Aerospace Medical Panel Specialist Meeting on Air to Ground Target Acquisition held in Brussels, Belgium, on the 31st May and 1st June 1972 are reported. The papers cover theoretical and practical aspects of visual search and detection including the effects of complex backgrounds, illumination and contrast, and the application of mathematical modeling techniques to the solution of target acquisition problems. For individual titles, see N73-19960 through N73-19974.

N73-19960 North American Rockwell Corp., Anaheim, Calif.
THE LIKELIHOOD OF LOOKING AT A TARGET
Charles P. Greening *In* AGARD Air to Ground Target Acquisition Nov. 1972 6 p (For availability see N73-19959 10-34)

Visual search behavior is characterized by brief glimpses of the terrain, separated by rapid eye movements, or saccades. The likelihood of looking at a target with any particular glimpse is, in most models of search behavior, assumed to result from either random motion or a mechanically systematic search pattern. In the present study, it is assumed that the observer uses extra-foveal vision to evaluate the terrain before each saccade, to maximize the likelihood of looking at the target. Quantitative data on extra-foveal search, obtained in a different context by Williams, show that such behavior is lawful and predictable. The results are here applied to dynamic air-to-ground search, yielding target acquisition predictions which compare favorably with those obtained by other methods. Author

N73-19961 British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
MODELING OF RANDOM HUMAN VISUAL SEARCH PERFORMANCE BASED ON THE PHYSICAL PROPERTIES OF THE EYE c05
Ian Overington *In* AGARD Air to Ground Target Acquisition Nov. 1972 12 p refs (For availability see N73-19959 10-34)

The physical properties of the eye lens and retina together with the involuntary eye movements (tremor and drift) are considered as the basic factors defining single glimpse detection probability. Introduction of the concept of convolution of object profiles with the spread function of the eye lens which allows extension of such single glimpse predictions to unsharp objects is discussed along with the effects of atmospheric attenuation and range dependency of subtended size. Using this comprehensive formula for single glimpse probability as an input a cumulative search probability model is developed for random search which takes account of search field of view, visual lobe effects and the transition from single glimpse to multiple glimpse situation at any part of the field of view. Author

N73-19962 British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
THE K FACTOR IN AIR-TO-GROUND ACQUISITION MODELLING c19
D. G. Silverthorn *In* AGARD Air to Ground Target Acquisition Nov. 1972 14 p refs (For availability see N73-19959 10-34)

This paper illustrates that correspondence obtained between the shapes of the probability-range curves is good both for field and simulated field detection data, but that actual performance levels are much lower than predicted. A degradation factor (the K factor) has been introduced to cover this discrepancy and a similar fudge factor has been invoked to cover differences between simulated and direct field trial data. The paper examines the factors on which K is dependent and describes relevant experiments and the associated attempts at modelling them. It is at once a progress statement and an indication of the necessary further studies. Author

N73-19963 Nottingham Univ. (England). Dept. of Psychology.
CALCULATION AND SIMULATION OF THE EFFECTS OF TWO COMPLEX SEARCH SITUATIONS
C. I. Howarth, J. R. Bloomfield, and M. E. Dewey *In* AGARD Air to Ground Target Acquisition Nov. 1972 12 p refs (For availability see N73-19959 10-34)

Two attempts were made to elucidate complex search situations. In the first, using Howarth and Bloomfield's theoretical work as a basis, calculations were made of the cumulative search time data likely to occur when a target that was an extreme example of a distribution of objects was presented among a sample of these objects. The calculations covered variations in (1) the target-nontarget cut-off point, (2) the size of the visual lobe area associated with the target, and (3) the response time that was necessary after a target was located. The second, a simulation study making use of the Monte Carlo method, treated a situation in which a number of targets were presented among many nontarget objects. A single target, which had a small visual lobe area associated with it, was presented with a variable number of targets with large visual lobe areas. The size of the visual lobe areas associated with the two kinds of target was varied,

as were the number of the large lobe area targets and the length of the response times necessary after a target had been located. The likely effect of these variations on the time needed to locate the single target is reported. In general, more time was needed the smaller the lobe area of the single target is reported. In general, more time was needed the smaller the lobe area of the single target, the greater the lobe area of the large lobe targets, the greater the number of the latter present, and the longer the response times. The cumulative curves obtained changed in shape as the four variables altered in these directions. The change in shape is likely to be found with human observers who adopt the most suitable strategy for locating the small lobe area target. Author

N73-19964 British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
THE EFFECT OF COMPLEX BACKGROUNDS ON ACQUISITION PERFORMANCE
M. B. Brown *In* AGARD Air to Ground Target Acquisition Nov. 1972 6 p refs (For availability see N73-19959 10-34)

The relationship between the subjective effect of structured target backgrounds on acquisition performance and physical attributes of the scene luminance structure was investigated both theoretically and experimentally. The theoretical attempts are described to classify various aspects of complexity, and an experiment was carried out using synthetic target material. The results showed that certain targets are more easily recognized than others for all the complex backgrounds used, and also indicated that recognition may be regarded as the detection of detail. A large variability between subjects was observed. Part of this variation can be attributed to eyesight differences and to experience. Author

N73-19965 Nottingham Univ. (England). Dept. of Psychology.
PERIPHERAL ACUITY WITH COMPLEX STIMULI AT TWO VIEWING DISTANCES c05
J. R. Bloomfield *In* AGARD Air to Ground Target Acquisition Nov. 1972 10 p refs (For availability see N73-19959 10-34)

Visual acuity is defined in terms of the minimum resolvable visual angle or its reciprocal. This assumes, implicitly, that acuity is independent of viewing distance. In the current study, this assumption was tested for peripheral acuity using two viewing distances. A complex visual display was used for the acuity task. The display contained a regular 17 by 10 arrangement of discs. The display was exposed for 0.25 seconds, with the observer fixating a particular point in it. Measurements were made of the threshold distance from the fixation point at which a single, smaller target disc could be detected. The data, obtained from eight observers, supported the assumption that peripheral acuity is independent of viewing distance; the threshold distance remaining unchanged for four sizes of target, in spite of the large change in viewing distance. This implies that performance in air-to-ground target acquisition should not be directly affected by variations in viewing distance. Author

N73-19966 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
A MODEL FOR THE INHERENT CONTRAST CONDITIONS IN FULL-FORM OBJECTS c23
Max R. Nagel *In* AGARD Air to Ground Target Acquisition Nov. 1972 21 p refs (For availability see N73-19959 10-34)

The concept was developed of a simple model that is representative of the luminance and contrast conditions on full-form objects. A reasonably realistic approach is a sphere that is exposed to the irradiation from the entire sky, the sun, and the ground, taking into account the considerable variation of the luminance in the sky. Based primarily on measurements of the sky luminance in the Pikes Peak region of Colorado, U.S.A., calculations were made of the inherent contrast in such a model when it is viewed from any direction with fields of view of various sizes. Other calculations were concerned with the model object's contour contrast against its background, and with its color. Representative results of these calculations are shown and discussed. Author

N73-19967 Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
AIR-TO-GROUND VISIBILITY OF LIGHTS AT LOW BACKGROUND LEVELS c05
John H. Taylor *In* AGARD Air to Ground Target Acquisition Nov. 1972 8 p refs (For availability see N73-19959 10-34)

After sunset and before sunrise the visual task of the airborne observer becomes radically different from that which he must perform during the daylight hours. The range at which targets will be seen depends upon the physical properties of the source, such as its intensity and color, the length of time for which it is exposed to view, the transmissivity of the atmospheric path of sight, and the visual performance capabilities of the observer. This paper describes some new data which apply to this problem, and suggests that the relationship between visibility and flash duration may be somewhat more complex than has usually been assumed. The results have application to both aggressive and defensive needs, and are of interest to the signalling community in general. Author

N73-19968 Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Environments Branch.
AIR-TO-GROUND TARGET ACQUISITION WITH FLARE ILLUMINATION c23
Robert L. Hilgendorf IN AGARD Air to Ground Target Acquisition Nov. 1972 11 p refs (For availability see N73-19959 10-34)

This paper is concerned with the results from three recent experiments. Experiment 1 dealt with the effect of shielding a 25,000,000-lumen flare source and determining the optimal number of flares to be used for a given target area. No statistically significant effect was found due to flare shielding. For the given target area simulated, it appeared that there was no additional benefit derived from igniting more than two flares over a simulated area of about 1.5 kilometers by 5 kilometers. Experiment 2 dealt with shielding of a 60,000,000-lumen source, and again, no statistically significant effect was found due to the flare shielding. Experiment 3 dealt with the visual acuity under simulated flare light. In this experiment, each of eight groups of five subjects performed simulated observer altitude ranging in 152-meter increments from 152 to 1,219 meters. For the slant ranges simulated (1,029 to 1,587 meters), 610 meters was the best altitude for visual performance. Like the other findings, this could have significant impact on tactical planning for night missions. The parameters of this study have now been blown-up to real-world size and the Aerospace Medical Research Laboratory, in conjunction with the Air Force Armament Laboratory, is conducting flight tests to validate the altitude data of the experimental simulations. Author

N73-19969 Army Aeromedical Research Lab., Fort Rucker, Ala.
AIR TO GROUND TARGET ACQUISITION
Robert W. Bailey *In* AGARD Air to Ground Target Acquisition Nov. 1972 5 p refs (For availability see N73-19959 10-34)

Biomedical problems with the helmet mounted sight and visual target acquisition system are discussed in terms of sighting errors in the laboratory and in flight for still and moving targets. The effects of this type optical device on depth and spatial perception are presented along with suggested bioengineering techniques for improving the system. F.O.S

N73-19970 Army Electronics Command, Fort Monmouth, N.J. Avionics Lab.
A DESIGN CONCEPT FOR A DUAL HELICOPTER NIGHT SCOUT SYSTEM
William J. Kenneally *In* AGARD Air to Ground Target Acquisition Nov. 1972 11 p refs (For availability see N73-19959 10-34)

Limited but promising operational experience with helicopter-borne night vision systems (both low light level TV and forward looking infrared) has spurred an interest in the application of night vision technology to second generation airborne systems. The limited quantitative performance data on these first generation systems, coupled with the significant advances in night vision technology made during the intervening period, place severe restrictions on the system designer attempting to make logical system tradeoffs. The scope of the paper is to examine various relevant data on the subject and to develop a design concept for such a second generation scout system. Author

N73-19971 Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
REALISTIC CONSIDERATIONS OF TARGET ACQUISITION

ON LINES OF COMMUNICATIONS
Roy K. Frick, Diane E. Summers, and Thomas E. Tyson *In* AGARD Air to Ground Target Acquisition Nov. 1972 10 p refs (For availability see N73-19959 10-34)

An approach is presented to determining the probability of acquiring targets by a search aircraft which flies along an enemy line of communication (LOC). A line of communication is defined as a route, e.g., a road, waterway, or railroad, and the targets of interest are trucks, boats, or other appropriate carriers. The analysis approach consists of three areas of investigation: (1) analyzing the contour (twists and turns) of a route for purposes of establishing a preferred flight path plus determining the frequency distributions of LOC aspects relative to this flight path, (2) computing the probability of detecting a target, given a set of LOC, target, and flight path conditions, and (3) integrating the results of the first two areas of investigation to produce the probability of target acquisition for the overall set of conditions. The methodology presented can be applied to investigate conditions of target acquisition for existing lines of communication in the real world. Author

N73-19972 University of Technology, Leicester (England). Dept. of Ergonomics and Cybernetics.
THE EFFECTS OF BRIEFING ON TELEVISUAL TARGET ACQUISITION c05
K. R. Parkes *In* AGARD Air to Ground Target Acquisition Nov. 1972 9 p refs (For availability see N73-19959 10-34)

Evidence from a number of studies indicates that the nature of the briefing information available to the observer has a marked effect on target acquisition performance. Low-level forward oblique photographs of the target and surrounding terrain have been found to be a particularly effective form of briefing information, but such photographs may not always be available. In the experiment reported, an evaluation was made of the extent to which, in the absence of suitable oblique photographs, perspective representations of the target and surrounding terrain, derived from maps, facilitated televisual target acquisition performance. The effectiveness of these perspective views, used as briefing material in addition to maps, was compared with that of maps used alone, and maps used together with oblique photographs. The results show that, while not as effective as oblique photographs, the perspective views brought about some improvement in performance as compared with the maps alone. Author

N73-19973 British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
THE USE OF KELLY'S REPERTORY GRID TECHNIQUE FOR ASSESSING SUBJECTIVE ESTIMATES OF IMPORTANT PARAMETERS FOR TARGET ACQUISITION
A. J. Mitchell *In* AGARD Air to Ground Target Acquisition Nov. 1972 12 p refs (For availability see N73-19959 10-34)

Kelly's Repertory Grid Technique was employed to study the area of subjective factors involved in visual acquisition of targets, in the hope of covering the discrepancy between the data obtained from psychophysical studies and actual field data. Two experiments were conducted using highly trained aircrew which have led to the definition of some subjective parameters, and estimates of their importance. Through analysis, three major overlying components were elicited. These major components were: (1) The target has visual prominence against the background. (2) The target is in a helpful built-up environment, or Target is in an urban environment. (3) There are geographical and map identification features around the target to aid acquisition. Author

N73-19974 British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
SOME PSYCHOMETRICS IN RELATION TO TARGET ACQUISITION c05
Sandra J. Seale *In* AGARD Air to Ground Target Acquisition Nov. 1972 7 p refs (For availability see N73-19959 10-34)

The variance associated with acquisition performance arises from between subject differences and within subjects differences. A recent intensive study was conducted, using a pattern discrimination test, the Witkin Embedded Figures Test (EFT). Previous experimental work using this test indicated that it would be suitable for the target acquisition situation in that it would estimate analytical ability, which was hypothesized as being a factor contributing to the variation in acquisition performance. Although no overall significance was found between EFT scores and measures of acquisition performance under various briefing conditions, the study highlighted the difficulties involved in using psychometric tests in the context of target acquisition. The paper examines these difficulties and illustrates the contribution to the methodology in this area. Author

N73-19975*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL QUARTERLY TECHNICAL REVIEW, VOLUME 2, NUMBER 4
1973 192 p refs
(Contract NAS7-100)
(NASA-CR-131152) Avail: NTIS HC $11.75 CSCL 05B

Papers and abstracts of scientific and technical reports are presented. For individual titles, see N73-19976 through N73-19985.

N73-19976* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
LIPID-ABSORBING POLYMERS c04
H. E. Marsh, Jr. and C. J. Wallace *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 1-6 refs (For availability see N73-19975 10-34)
CSCL 06E

The removal of bile acids and cholesterol by polymeric absorption is discussed in terms of micelle-polymer interaction. The results obtained with a polymer composed of 75 parts PEO and 25 parts PB plus curing ingredients show an absorption of 305 to 309%, based on original polymer weight. Particle size effects on absorption rate are analyzed. It is concluded that crosslinked polyethylene oxide polymers will absorb water, crosslinked polybutadiene polymers will absorb lipids; neither polymer will absorb appreciable amounts of lipids from micellar solutions of lipids in water. F.O.S.

N73-19977* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Applied Mechanics Div.
UNIFIED APPROACH TO THE BIOMECHANICS OF DENTAL IMPLANTOLOGY c04
D. E. Grenoble (Univ. of Southern Calif., Los Angeles) and A. C. Knoell *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 7-17 refs (For availability see N73-19975 10-34)
CSCL 06E

The human need for safe and effective dental implants is well-recognized. Although many implant designs have been tested and are in use today, a large number have resulted in clinical failure. These failures appear to be due to biomechanical effects, as well as biocompatibility and surgical factors. A unified approach is proposed using multidisciplinary systems technology, for the study of the biomechanical interactions between dental implants and host tissues. The approach progresses from biomechanical modeling and analysis, supported by experimental investigations, through implant design development, clinical verification, and education of the dental practitioner. The result of the biomechanical modeling, analysis, and experimental phases would be the development of scientific design criteria for implants. Implant designs meeting these criteria would be generated, fabricated, and tested in animals. After design acceptance, these implants would be tested in humans, using efficient and safe surgical and restorative procedures. Finally, educational media and instructional courses would be developed for training dental practitioners in the use of the resulting implants. Author

N73-19978* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
THERMOLUMINESCENCE: POTENTIAL APPLICATIONS IN FORENSIC SCIENCE c23
J. D. Ingham and D. D. Lawson *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 18-28 refs (For availability see N73-19975 10-34)
CSCL 20J

In crime laboratories one of the most difficult operations is to determine unequivocally whether or not two samples of evidence of the same type were originally part of the same thing or were from the same source. It has been found that high temperature thermoluminescence (room temperature to

723 K) can be used for comparisons of this type, although work to date indicates that there is generally a finite probability for coincidental matching of glass or soil samples. Further work is required to determine and attempt to minimize these probabilities for different types of materials, and to define more clearly the scope of applicability of thermoluminescence to actual forensic situations. Author

N73-19979* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

A HIGH-EFFICIENCY, SMALL, SOLID-STATE LASER FOR PYROTECHNIC IGNITION c16

L. C. Yang and V. J. Menichelli *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 29-37 refs (For availability see N73-19975 10-34)

CSCL 20E

A completely self-contained, small, neodymium laser has been designed and demonstrated for use in a pyrotechnic ignition system. A nominal 16 J of laser energy (1.06 micron wavelength, 1-ms duration) was achieved in a rectangular 10.5-X 15.1-X 25.4-cm package weighing 5.14 kg. This high energy-to-weight ratio is encouraging for laser applications in which specific energy efficiency (energy per unit weight or volume) is important. The laser design concepts are described, and some results on pyrotechnic ignition are given. Some details on a laser currently under construction, which will be 1/8 the size of the above laser, are included. Author

N73-19980* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

GENERATION OF NARROW HIGH CURRENT PULSES c09

V. J. Menichelli and L. A. Rosenthal *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 38-43 (For availability see N73-19975 10-34)

CSCL 09C

Many of the fundamental factors affecting the initiation of electroexplosive devices have not been satisfactorily explained. A description of a narrow, high current pulse generator capable of pulses 4 microseconds wide and 94 amperes is given which will be useful in the study of the initiation mechanism. Author

N73-19981* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.

DEVELOPMENT OF A THICK-FILM SILICON RIBBON GROWTH TECHNIQUE FOR APPLICATION TO LARGE-AREA SOLAR CELLS AND ARRAYS c03

P. A. Berman *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 44-52 refs (For availability see N73-19975 10-34)

CSCL 10A

A new technique is described for growth of large-area silicon ribbons. This technique is an edge-defined, film-fed growth process by which single crystals can be grown having a shape controlled by the outside dimensions of a shaping die, growth taking place from an extremely thin film of liquid fed by capillary action from a crucible below. The material from which the die is fabricated is very critical to the process. The die must be wet by the silicon, but adverse impurities must not be introduced into the silicon, and the die must not become degraded by the molten silicon. A breakthrough in die fabrication that has allowed the growth of silicon ribbons having dimensions of 1 cm by 30 cm with a thickness of 0.7 mm is described. The implications of this significant advancement with respect to development of photovoltaic solar arrays for wide-scale terrestrial solar-to-electric energy conversion systems are discussed. Author

N73-19982* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Data Systems Div.

INFORMATION MANAGEMENT SYSTEM FOR THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD (SWRCB) c08

T. C. Heald and G. H. Redmann *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 53-61 (For availability see N73-19975 10-34)

CSCL 05B

A study was made to establish the requirements for an integrated state-wide information management system for water quality control and water quality rights for the State of California. The data sources and end requirements were analyzed for the data collected and used by the numerous agencies, both State and Federal, as well as the nine Regional Boards under the jurisdiction of the State Board. The report details the data interfaces and outlines the system design. A program plan and statement of work for implementation of the project is included. Author

N73-19983* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.

ON THE FEASIBILITY OF EFFICIENT MULTIAMPLITUDE COMMUNICATION c07

J. G. Smith *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 62-71 refs (For availability see N73-19975 10-34)

CSCL 17B

Bandwidth constraints in earth-satellite communication systems force consideration of uncoded M-ary modulation to obtain increased data rates. M-ary phase shift keying (MPSK) at first glance seems most promising because of the high transmitter efficiency achieved through Class C operation. Multiple phase-and-amplitude modulation candidates such as quadrature amplitude shift keying (QASK) appear less promising because the transmitter must operate at lower efficiency (in linear or multimode operation). However, initial studies indicate that QASK offers significant raw dc-power savings over MPSK, despite the reduced transmitter efficiency. For example, at S-band both solid-state and traveling wave tube (TWT) QASK transmitters can provide a 3-dB average dc-power savings over comparable 16-ary phase shift keying (PSK) for the same bit rate and error probability. The reason for this savings is that QASK requires much less average signal-to-noise ratio than 16-ary PSK for the same error rate. Author

N73-19984* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.

HELICOPTER VISUAL AID SYSTEM c23

R. L. Baisley *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 72-86 ref (For availability see N73-19975 10-34)

CSCL 20F

The results of an evaluation of police helicopter effectiveness revealed a need for improved visual capability. A JPL program developed a method that would enhance visual observation capability for both day and night usage and demonstrated the feasibility of the adopted approach. This approach made use of remote pointable optics, a display screen, a slaved covert searchlight, and a coupled camera. The approach was proved feasible through field testing and by judgement against evaluation criteria. Author

N73-19985* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Data Systems Div.

THE MESA ARIZONA PUPIL TRACKING SYSTEM c05

D. L. Wright *In its* JPL Quart. Tech. Rev., Vol. 2, No. 4 1973 p 87-92 (For availability see N73-19975 10-34)

CSCL 05E

A computer-based Pupil Tracking/Teacher Monitoring System was designed for Mesa Public Schools, Mesa, Arizona. The established objectives of the system were to: (1) facilitate the economical collection and storage of student performance data necessary to objectively evaluate the relative effectiveness of teachers, instructional methods, materials, and applied concepts; and (2) identify, on a daily basis, those students requiring special attention in specific subject areas. The system encompasses computer hardware/software and integrated curricula progression/administration devices. It provides daily evaluation and monitoring of performance as students progress at class or individualized rates. In the process, it notifies the student and collects information necessary to validate or invalidate subject presentation devices, methods, materials, and measurement devices in terms of direct benefit to the students. The system utilizes a small-scale computer (e.g., IBM 1130) to assure low-cost replicability, and may be used for many subjects of instruction. Author

N73-19986# Defence Standards Labs., Maribyrnong (Australia).

[ENVIRONMENTAL AND MATERIALS EFFECTS ON MILITARY EQUIPMENT] Annual Report, 1971 - 1972

1972 88 p Original contains color illustrations

Avail: NTIS HC $6.50

Research in protecting equipment from the tropics and the sea is reported along with the developments in explosives. Topics discussed include: marine environment; tropical environment; explosives and munitions; polymers, composites and ceramics; metals; paints; and biochemistry. A list of published papers is also included. F.O.S.

N73-19987# National Science Foundation, Washington, D.C.
GRANTS AND AWARDS FOR FISCAL YEAR 1972
1972 251 p
(NSF-73-2) Avail: NTIS Avail: SOD $3.75

The grants for scientific research are listed. The institution, principal investigator, project title, costs and duration are given for each grant. Areas in which the grants were awarded include: biology; astronomy, mathematics, physics and chemistry; atmospheric and earth science; specialized research facilities and equipment; national, international, and special research programs; and science information services. F.O.S.

N73-19988# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
[ORGANIZATION OF DFVLR AND RESEARCH ACTIVITIES DURING 1971] Annual Report, 1971
1971 494 p refs In GERMAN
Avail: NTIS HC $26.75

The organization and management of the society are outlined and research work is reported in the following faculties: fluid mechanics, aeromechanics and flight control, solid materials and construction methods, propulsion and energy, electronics, aerospace physics, space simulation, and aerospace medicine.
Transl. by G.G.

N73-19989*# Houston Univ., Tex. Dept. of Civil Engineering.
THE ECONOMIC AND SOCIAL ASPECTS OF SANITARY LANDFILL SITE SELECTION
W. J. Graff and J. R. Rogers 31 Oct. 1972 29 p refs
(Contract NAS9-12646)
(NASA-CR-128745) Avail: NTIS HC $3.50 CSCL 06I

The factors involved in the selection of suitable sites for sanitary land fills are discussed. The economic considerations and problems of social acceptance are considered the most important. The subjects discussed are: (1) accessibility of land, (2) availability of cover material, (3) expected capacity of site, (4) cover material and compaction, (5) fire protection, (6) site location with respect to residential and industrial areas, and (7) land usage after landfill completion. Author

N73-19990*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
CALIBRATION FACILITY SAFETY PLAN
William G. Fastie 18 Oct. 1971 19 p
(Contract NAS9-11528)
(NASA-CR-128833) Avail: NTIS HC $3.00 CSCL 13L

A set of requirements is presented to insure the highest practical standard of safety for the Apollo 17 Calibration Facility in terms of identifying all critical or catastrophic type hazard areas. Plans for either counteracting or eliminating these areas are presented. All functional operations in calibrating the ultraviolet spectrometer and the testing of its components are described.
J.M.M.

N73-19991# Mitre Corp., Bedford, Mass.
TEST RESULTS: PLRACTA (POSITION LOCATION REPORTING AND CONTROL TACTICAL AIRCRAFT) REMOTE STATION AT ARMY NIKE MISSILE SITE
M. L. Zeichner Dec. 1972 35 p
(Contract F19628-73-C-0001; AF Proj. 517A)
(AD-754231; MTR-2478; ESD-TR-72-401) Avail: NTIS CSCL 15/3

The PLRACTA (Position Location Reporting and Control Tactical Aircraft) Mobile Remote Station was driven to the Army Nike Missile Site in Lincoln, Mass., and interfaced with the site acquisition radar. Tests were conducted to demonstrate how PLRACTA information could enhance the identification process and provide early warning information. The document summarizes the results of these tests. Author (GRA)

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EUROPEAN

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Liquid Propellant Rocket Combustion Instability (NASA SP–194)

Edited by DAVID T. HARRJE AND FREDERICK H. REARDON

This reference book presents the significant theoretical and experimental developments in the field of combustion instability. As an aid to development, design, and research engineers, fundamental principles and relations between alternate approaches are emphasized. Also discussed are the phenomena of combustion instability, combustion, and flow processes. Basic concepts of various analytical models are given along with descriptions of how to use each model. Methods for exciting and damping instability oscillations are presented along with experimental techniques used to investigate instability problems. *Paperbound.* 664 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $5.50.

NASA Contributions to Fluidic Systems (NASA SP–5112)

By TERRY M. WEATHERS

A technology utilization survey describing how the specialized requirements of NASA and others have influenced the evolution of fluidic systems through study of promising applications, ranging from controls for a nuclear rocket engine (where radiation presents serious problems for electronic systems) to fluidic control of automatic turret lathes. The fluidics industry is also discussed. *Paperbound.* 112 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $1.00.

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